THE AUSTRALIAN AND NEW ZEALAND
JOURNAL OF SURGERY

Registered at the General Post Office, Melbourne, for transmission by post as a periodical.

VOL. III. JANUARY, 1934. No. 3.

RECTO-SIGMOID AND SIGMOID SURGERY.

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IN this paper I propose to describe a method of operating on the distal part of the colon for those affections which are not amenable to Paul's method or its modifications, and in which, if the usual methods of operation were adopted, the life of the patient would be either seriously imperilled or else it would be necessary to leave him with a permanent artificial anus.

OPERATIVE RISKS IN THE PROXIMAL AND DISTAL PARTS OF THE COLON.

Statistics show that the patient is involved in a much greater risk by operations on the distal half of the colon than by those on the proximal part. This is to be expected, because the conditions which govern the safety of operations on the bowel are not so favourable in the left part of the colon as in the right. From an operative point of view, therefore, the colon cannot be considered as a whole.

The right part of the colon—the caecum and ascending colon—has limited digestive and absorptive powers. Its anatomical structure and its physiological conditions approximate those of the lower part of the small intestine: it has a moderately good blood supply, a reasonably good anastomic circulation, its contents are fluid and only moderately infective. Furthermore, the operation of choice for a lesion of the caecum or of the ascending colon consists of an ileo-colic resection and an ileo-colic anastomosis. Thus, as the small intestine forms one member of the anastomosis, we take advantage of the safer conditions which prevail in the surgery of the small intestine. As regards mortality, therefore, operations on the proximal part of the colon are more on a level with those in the small intestine.

The distal part of the colon does not digest or absorb food products, and is almost entirely excretory. Thus it serves rather a subordinate function, and consequently does not command a rich blood supply. In some places its walls are thin, and in others the peritoneum is absent or its protective effect is embarrassed by deposits of fat. In the most distal part of the colon the contents are semi-solid and infective, and the muscular expulsive contractions are more powerful than is generally thought. Where an ileo-colic anastomosis, which is required after a resection for a lesion of the caecum or of the ascending colon, is comparatively safe, a recto-sigmoid anastomosis, which should be necessary after the removal of a lesion at the lower end of the distal colon or the recto-sigmoid junction, is so dangerous that it is rarely undertaken. Consequently, the patient is generally left with a permanent artificial anus. Thus it is obvious that the normal conditions which are present in the distal part of the colon are unfavourable for those methods of anastomosis which are successful in the small intestine and the proximal part of the colon. This is also evident from some of the published statistics of the mortality for sutured anastomotic operations in the sigmoid colon. These show high death rates. The deaths are nearly all due to some form of local or general peritonitis caused by infection, either from soiling at the time of the operation or from the anastomosis subsequent to the operation.

Discussion on Present Operative Methods.

In order to obviate the infective factor, which is the cause of mortality in the ordinary anastomosis, the so-called "aseptic anastomoses" have been designed. There are two possible causes of failure in this method. The first is the fact that, in the circumstances, it is impossible to make any anastomosis aseptically; and also, even if it were possible, infection could subsequently spread along the sutures in the thin colon wall. Secondly, these methods still do not avoid the danger which is inseparable from any sutured anastomosis; that is, the precarious circulation, and, therefore, uncertain vitality, of the severed ends of the bowel. Since I have adopted the modified Paul type of partial colonic resection, I have observed how important this circulatory deficiency is, and how unexpectedly it occurs. Many times, when I have been quite sure of the viability of the cut ends of the bowel, which I have implanted in the abdominal wall, I have been surprised to find that limited necrosis has occurred.

It was to avoid dangers of an anastomotic operation, as I have described them, that I devised, six years ago, and adopted for routine use where possible, a modification of Paul's method of partial colectomy.[1] [2] This method depends for its safety on the facts that the peritoneum is not soiled at the time of the operation, and that, as no sutures are used in making the anastomosis, it cannot be infected subsequently. In ordinary circumstances the mortality from this method is almost negligible. It has, however, the great disadvantage that it is not applicable to growths situated in the upper or lower end of the

sigmoid, or the descending colon, or the splenic flexure; or to the various phases of diverticulitis which are generally associated with a surrounding inflammation.

THE METHOD ADVOCATED.

The method which I wish to advocate is based on the principle that the operation is carried out on a distal part of the colon, which has been rendered completely functionless, which has been aseptically prepared, and, furthermore, which is allowed to remain functionless till any anastomosis has completely healed.

FIGURE I. Photograph showing a dilated obstructed transverse colon in which the limbs of the most dependent loop are sutured together preparatory to making a mid-colic anus. 1 = Loop of transverse colon. 2 = Pubis.

FIGURE II. Photograph showing the loop of transverse colon drawn up through an opening in the upper part of the abdomen, and the clamps applied. 1 = Umbilicus. 2 = Pubis.

The distal segment of the colon can be entirely deprived of its function by taking advantage of the fact that an artificial anus in the transverse colon can be so constructed that it will completely exclude the distal part of the colon, and yet permit of the continuity of the bowel being restored, without inflicting a further operation on the patient; that is, the function of the distal colon can be readily switched on and off as desired. In the formation of this mid-colic anus, the guiding principles are as follows: (i) to make the spur as long as possible (about 8·25 centimetres or three and a half inches long), and exactly at right angles to the axis of the bowel; (ii) to attach the end of this spur to the skin so that it cannot retract and allow soiling of the distal segment; (iii) to make the artificial anus as small and neat

as possible, with its mucous membrane just level with the surface of the skin.

The anus is made in the following way: In order to obtain the long and well defined spur advantage is taken of the mobility and length of the transverse colon, and the adjoining limbs of its most dependent part are sutured together (Figure I). The sutured loop is then drawn up through a small opening in the upper part of the left rectus muscle (Figure II), and, with a diathermy knife, divided between clamps flush with the skin surface (Figure III). In order to enable the end of the spur to become attached to the skin, a small segment of skin is sutured between the clamps (Figure IV, arrow). This prevents retraction of the spur into the abdomen, which otherwise begins to take place after ten days, and which would allow

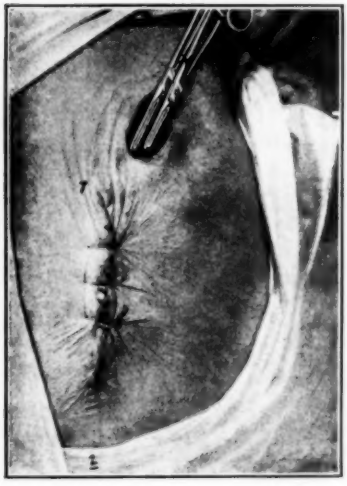

FIGURE III. Photograph showing the bowel divided between the clamps. The clamps are fixed on to the abdominal wall for twenty-four hours with a suture of silkworm gut (3). 1 = Umbilicus. 2 = Pubis.

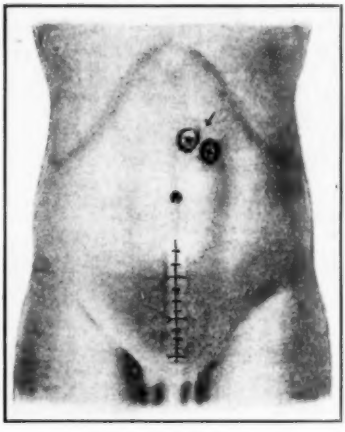

FIGURE IV. Showing the situation of the mid-colic anus. The arrow points to the small segment of skin to which the end of the spur becomes attached.

some of the contents of the proximal to soil the distal colonic segment. The anus so made should have the appearance of the end of a double barrelled gun (Figures IV, V and VII).

The advantages obtained from a mid-colic anus which is formed in this way are as follows:

1. The carefully made vertical spur, which is attached to the skin, completely and permanently disconnects the distal part of the colon from the rest of the bowel.

2. The opening in the distal colonic segment is readily accessible for the introduction of a tube, so that the necessary lavage can be carried out by the nursing staff.

3. The long spur allows a long enterotome to be used, with which a deep connexion with the bowel segments can be made well below the artificial anal opening. The depth of this opening enables the bowel contents to be grasped completely by a peristaltic wave, so that the greater part naturally passes on rather than through the anus. Thus, though the artificial anus may be wide open, it allows very little fæces to leak, and consequently the patient suffers very little inconvenience till it closes or is closed.

4. As the anus is small, and as it has no redundant mucous membrane, natural healing can take place; or, if this is not the case,

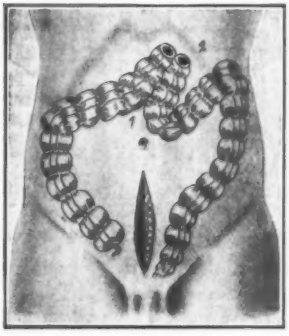

FIGURE V. Diagrammatically showing how the mid-colic anus (2) completely excludes the distal part of the colon from the proximal. 1 = Sutured loop of transverse colon.

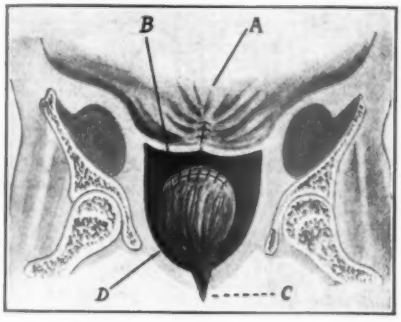

FIGURE VI. Frontal section (diagrammatic) through the pelvis to show how the muscle and mucous layers of the stump of the rectum are sutured in one layer (A), and the peritoneum in another (B). C = Anal canal. D = Rectal stump.

it will require only a minor procedure, under local anæsthesia, in order to close it. Its neatness also prevents prolapse of the mucous membrane.

5. The anus in this position drains an acutely obstructed bowel just as well as the one in the sigmoid which is usually made. It drains the bowel better than a caecostomy, because it is nearer to the obstruction.

6. The high situation of the anus enables an operation on the sigmoid colon to be carried out in a comparatively clean area.

THE ADVANTAGES OF OPERATING ON A FUNCTIONLESS BOWEL.

The elimination of function in the distal part of the colon gives the surgeon a control of those conditions in the sigmoid which make operations on it so dangerous. He is now able to perform a resection and anastomosis of the sigmoid in the following propitious circumstances:

1. The bowel has no septic content, and is devoid of peristaltic movement; it is collapsed and its walls are, therefore, retracted and

thick. An anastomosis made in these circumstances is almost devoid of risk.

2. If for any reason the circulation of the divided ends be in doubt, they may be anchored at convenient places in the wound. Should necrosis occur, it can be allowed to separate. Even if it does not occur, any defective circulation will quickly improve. It is then a small matter, at a subsequent operation under local anæsthesia, to join up the ends, which we now know are properly vascularized.

3. It is possible to peritonealize the cut end of the bowel which is devoid of peritoneum. For example, in a resection of sigmoid, in which it is necessary also to remove the upper part of the rectum, the upper cut end of the sigmoid can be implanted in the wound; the divided rectum can be closed and peritoneum flaps sutured over it. In a few weeks the peritoneum will become firmly united to the rectum. An anastomosis can then be made between the two segments, both of which are now covered with peritoneum.

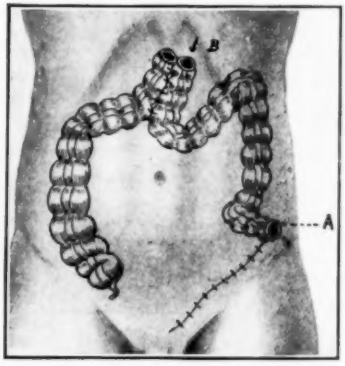

FIGURE VII. Showing diagrammatically the excluded distal segment of the colon after the sigmoid and upper part of the rectum have been removed. Arrows show the direction in which this segment is washed out. A = Beginning of sigmoid colon sutured into loin. B = Mid-colic anus.

4. In the surgery of diverticular tumour of the sigmoid, which is frequently complicated by inflammation and its sequelæ, the complete elimination of function serves a two-fold purpose. It causes the inflammatory complication to subside, so that the actual limits of the diverticulum-bearing area may be recognized, and unnecessarily extensive resections can thus be avoided. On the other hand, after the extensive resections that are often necessary, it permits of a safe anastomosis being made between segments of bowel which are usually devitalized by the effects of inflammation.

APPLICATION OF THE METHOD TO DIFFICULT PROBLEMS IN THE SURGERY OF THE SIGMOID.

This method of operating on the excluded sigmoid colon was designed for dealing with those very difficult problems in the surgery of the sigmoid and the recto-sigmoid, which nowadays seem to arise so frequently, and for which, up to the present, there has been no satisfactory surgical treatment. These problems comprise two main types.

In the first type of problem we are concerned with the surgical management of the various pathological phases of diverticulitis in which

(*a*) the whole sigmoid colon is affected; (*b*) part of the sigmoid is involved, but the diverticular tumour is complicated by a sigmoiditis, or by an abscess, or by fistulæ; or (*c*) it is associated with an acute intestinal obstruction.

In this type, if the ordinary methods of treatment be followed, the undermentioned difficulties, disadvantages and dangers are obvious:

1. That, because the sigmoid, being inflamed, must be rigid and fixed, it cannot be delivered out of the abdominal cavity so as to make a satisfactory artificial anus with a vertical spur. For the same reason a safe operation after Paul's method is impossible.

2. That, as the actual diverticular affection may be small, and the complicating inflammation wide, if resection be carried out on the appearances of the tumour, much more bowel will be sacrificed than is necessary.

3. That an anastomosis, in which segments of bowel are still inflamed, is very likely to break down.

4. That, as diverticulitis is a non-malignant affection, we are not justified in subjecting a patient to the danger entailed by the ordinary methods of operation on the functioning sigmoid.

5. That many patients have to suffer the misery of having an artificial anus for what may be a long life, either because the surgeon would not take the risks of resecting a widespread or complicated diverticular tumour, or because, if he did resect it, he was not able to join up the divided ends of the bowel.

In the second type of problem we are concerned with that carcinoma of the sigmoid which is so situated that, after resection, it is very difficult and dangerous to reconstitute the continuity of the bowel. This occurs in carcinoma of the descending colon or upper part of the sigmoid, where we are faced with the problem of making a sutured anastomosis of segments of bowel, which, in parts, are unperitonealized. It also occurs in the carcinoma of the lower end of the sigmoid, where the surgeon will leave the patient with an artificial anus rather than attempt to make the difficult and dangerous recto-sigmoid anastomosis.

ILLUSTRATIVE CASE REPORTS.

In order to illustrate the importance of the principle underlying the method advocated, I propose to report histories of three patients, each of which represents a difficult problem in the surgery of the distal part of the colon. Each of these patients, if operated on by the usual methods in vogue, would probably have been left with an artificial anus.

Case I.—Intestinal Obstruction: Carcinoma of the Lower End of Sigmoid: Diabetes: Mental Deficiency.

A man, aged sixty, very debilitated and emaciated, was admitted to the hospital with acute intestinal obstruction. His abdomen was very distended, and he had all the usual symptoms of an acute intestinal obstruction. From the history and the examination it was obvious that the cause of the obstruction

was a carcinoma of the sigmoid. Further examination disclosed that the patient was suffering from diabetes in an advanced stage. He was, of course, a bad "surgical risk", especially as any operation must involve the distal part of the colon. The patient was given an intravenous injection of glucose solution and insulin. The abdomen was opened in the mid-line, through an incision just large enough to allow an exploration to be made, with the object of ascertaining the operability of the growth, the presence of any metastases, the situation of the growth, and whether this could be removed by the modified Paul's method; and, in the light of the type of operation that would subsequently be required to determine the best situation in which to place a colostomy, in order to drain the obstructed bowel. The exploration revealed a carcinoma situated so close to the recto-sigmoid junction that a modified Paul's operation could not be performed, and made it clear that, if the growth were resected, an anastomosis between the remaining segment of the sigmoid and the upper part of the rectum would be necessary. In order to drain the obstructed bowel, and at the same time to render the distal part of the colon functionless, a mid-colic anus was made in the manner already described (Figures I, II, III and IV). Twenty-four hours after the operation the clamps were removed. Later, when the slough, which was caused by the pressure of the forceps, separated, the mucous membrane edges were found to be level with the skin, and the anus was now small and neat (Figure IV). The distal segment of the colon was now washed out from the artificial anus, and the rectum was also irrigated. Three weeks were allowed to intervene so that the patient might recover from his intestinal obstruction and be treated for his diabetic condition. He was then subjected to an operation for the removal of the carcinoma.

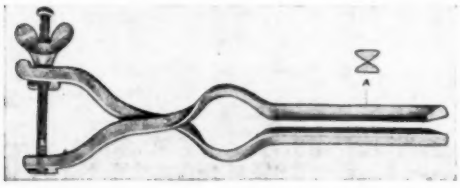

FIGURE VIII. Enterotome with bevelled edges, used for crushing the spur. (Reproduced by courtesy of *The Lancet*.)

Under Kirschner's zonal method of spinal anæsthesia, the patient was reoperated on, and the sigmoid was divided in the middle, the peritoneum was reflected from the pelvic floor, the rectum was divided well below the recto-sigmoid junction, and the lower half of the sigmoid with the upper part of the rectum was removed. The mucous and muscle layers of the rectum were closed with catgut sutures (Figure VI), and the peritoneal flaps were closed over the sutured rectum by a separate layer of sutures. A potential space was thus left between the peritoneal layer and the sutured stump of the rectum. A tube was inserted down to the sutured rectum. The cut end of the proximal segment of the sigmoid was sutured into a small split-muscle opening in the left iliac region (Figure VII, A). The left segment of the colon could now be washed through from the transverse colostomy (see arrows, B and A, Figure VII).

Two months later, when the peritoneum had grown on to the rectum and most of the inflammation associated with a healing wound had subsided, the patient was again operated on and the abdomen reopened. The terminal end of the sigmoid was dissected out of the abdominal wall and united to the stump of the rectum by a double row of interrupted sutures. In this cramped situation the insertion of sutures was difficult, but any defective suturing was not of great importance because both of the bowel segments were functionless. A drainage tube was placed near the anastomosis.

Three weeks later, when the anastomosis had firmly united, the spur of the transverse colostomy was crushed by my specially designed enterotome (Figure VIII). This enterotome is long, has generously bevelled edges, and a narrow crushing edge. Its blades are detachable, so that one can be put on at a time.

This enterotome produces a graduated pressure and thus makes wide adhering margins to the anastomosis.

One week later the artificial anus was closed. By this time it had contracted and was so small that in order to close it only a minor procedure, a few stitches, under a little local anæsthesia, was required.

The subsequent history of the patient showed that he had normal function.

FIGURE IX. Showing a skiagram (Case II) of the distal part of the colon and the rectal stump. (This was filled from the anal canal.) After four years the distal end of the descending colon had elongated a little from the increased function imposed on it. Note the smallness of the rectal stump. 1 = Lower end of descending colon. 2 = Stump of rectum.

In this case, the alternative was to remove the lower half of the sigmoid with part of the rectum, to close the divided end of the rectum, and to leave the patient an artificial anus. But in this particular

instance the patient was mentally not quite normal, and would not have been able to look after an artificial anus.

Case II.—Acute Intestinal Obstruction: Inflammatory Diverticular Tumour of the Whole Sigmoid.

A very fat man, aged fifty-six, a hotelkeeper, developed acute intestinal obstruction. He was operated on in the country, and what appeared to be an inoperable carcinoma of the sigmoid was found. In order to relieve the obstruction, an artificial anus was made in the upper end of the sigmoid.

Subsequent investigation by me created the suspicion that the tumour was inflammatory, and that it was the result of an extensive diverticulitis.

At a second operation, the whole of the sigmoid, including the portion bearing the artificial anus, was removed. It seemed impossible to approximate the divided ends of the bowel, and therefore to make an anastomosis. Consequently it was necessary to close the divided rectum by suturing separately the muscle layer and the peritoneum (Figure VI), and also to implant the distal cut end of the beginning of the sigmoid into the loin, where it would function as an artificial anus (Figure VII).

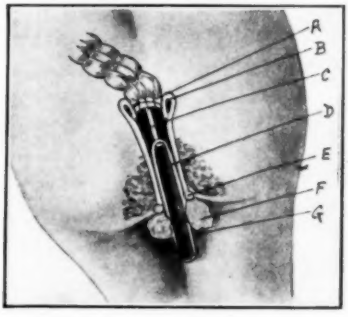

FIGURE X. Showing diagrammatically a section of the rectum viewed posteriorly, and the slotted tube attached to the lower end of the cut end of the distal part of the colon drawn through the anal canal and fixed there. A = Ring of skin round artificial anus sutured to rubber tube. B = Invagination of cut end of rectum. C = Rubber tube. D = Sliced part of tube. E = Sphincter grasping slender sliced part of tube and preventing it coming out. F and G = Gauze and safety-pin preventing the tube from going up.

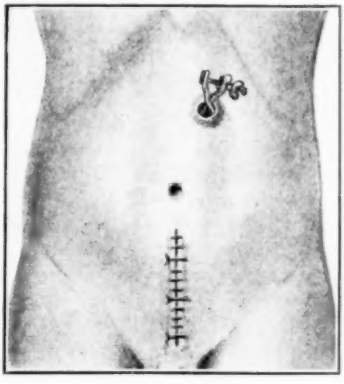

FIGURE XI. Showing the long enterotome applied to the mid-colic anus.

Four years later, at the request of the patient, who could not any longer tolerate the artificial anus, I decided to make an attempt to unite the descending colon to the rectum. (The skiagram, Figure IX, shows the level of the division of the beginning of the sigmoid and the smallness of the rectal stump.)

The method of doing this was as follows:

1. A mid-colic anus was made in the manner already described.
2. For a period of fourteen days the descending colon and the rectum were cleaned by daily lavage.
3. An anastomosis was then made as follows: (*a*) The abdomen was opened by a median subumbilical incision. (*b*) An incision was so made round the artificial anus that a substantial ring of skin was left attached to the mucous membrane. The anus was then disconnected from the abdominal wall, and the

descending colon was extensively mobilized. (*c*) A rubber tube 2·5 centimetres (one inch) in diameter, cut as shown in Figure X, was now sutured to the ring of skin which had been left attached to the artificial anus for this purpose. (*d*) A sponge holder with a swab on the end was now introduced through the anus into the rectum and pressed against its upper blind end. An incision 3·75 centimetres (one and a half inches) long was made through the rectal wall. The forceps was now made to grip the end of the tube and draw it, with the attached bowel, through into the rectum (Figure X). The rectal stump had contracted from disuse, and, as the patient was very fat, a tunnel had therefore to be made posteriorly to the bladder before the rectum could be incised. Consequently, when the bowel was drawn through this tunnel, there was no space whatever which would permit the manipulations required for the insertion of sutures in order to unite the cut edge of the rectal wall to that of the colon. Union of the bowel ends was then attained as follows: (*e*) The obliquely cut part of the tube was drawn down through the anus and kept in this position by means of gauze and a very large safety-pin inserted as shown in Figure X. The sphincter, grasping the obliquely cut part of the tube, prevented the tube from moving downwards. The safety-pin prevented it from going upwards. The bowel ends were therefore held in the position in which they were placed. The slotted part of the tube drained any contents which might have accumulated in the rectal cavity. A tube, for drainage purposes, was placed down to the junction of the colon with the rectum.

The convalescence of the patient was uneventful. Four weeks after the operation, when it was found that the anastomosis was firmly healed, a little local anæsthetic was injected into the small strip of skin between the bowel ends, and the spur of the mid-colic anus was crushed (Figure XI). The artificial anus then closed naturally in a very short time.

Both these patients have functioned normally for nearly a year, and a barium enema shows in each case that the junction is widely patent.

Case III.

A very old and debilitated man developed a subacute intestinal obstruction from a carcinoma situated too low in the sigmoid for a Paul's operation. An anus, so situated that it would eliminate sigmoid function, was made. At the same time, the growth was quickly resected, and both ends, the lower one short, were left in the wound. Some necrosis occurred on the lower end.

Two months later, when the bowel ends were well vascularized, and the general health of the patient had improved very much, the ends were united. When the anastomosis had healed, the contents of the colon were turned back into the sigmoid. These multiple small operations had no ill effect whatever on this extremely debilitated patient.

Discussion.

Cases I and II presented most difficult problems in the surgery of the distal colon.

In the first case we had to deal with a metabolic state in which wound repair, no matter how well prepared the patient was, must be defective; and, in addition, with a growth so unfavourably situated that the restoration of continuity of the bowel must be attended by the greatest technical difficulties and danger, making it certain that, if operated on by the routine methods, the patient would, at least, be left with an artificial anus.

In the second case, in an obese and unhealthy patient, an anastomosis of the upper third of the rectum to the upper end of the sigmoid colon was made, without using a single suture, under circumstances which could not conceivably have been more unsuitable or difficult.

In both these instances the patients were as little endangered or disturbed in the post-operative course as in the ordinary type of major operation. This can only be attributed to the fact that the operation was performed, and healing allowed to take place, on a functionless bowel. It should also be noted that the closure of the artificial anus gave very little trouble; and that, in the second case, it actually closed by natural means. This was due partly to the situation of the anus, partly to its smallness and neatness, but principally to the deep spur which could be so extensively crushed.

Case III only shows how safely a sutured anastomosis may be made in the sigmoid under adverse circumstances. It may therefore be taken that the experiences in Cases I and II have established two important principles in the surgery of the distal colon. These are:

1. That extensive resections and sutured anastomoses, under very difficult conditions, can be safely made on the distal part of the colon, if it is rendered functionless and kept so till complete healing takes place.

2. That a mid-colic anus can be so constructed that it will (*a*) drain an obstructed bowel, (*b*) completely deprive the distal part of the colon of its function, (*c*) permit the easy restoration of this function, (*d*) close with very little operative help.

SUMMARY.

1. A principle is established, in the surgery of the distal part of the colon, whereby extensive resections can be carried out safely with preservation of natural function.

2. The histories of three patients, chosen to illustrate the use and the value of this principle, are reported.

3. Stress is laid on the importance of the method advocated in the surgical treatment of the various phases of diverticulitis of the sigmoid, and of carcinoma of the upper or lower end of the sigmoid or of the recto-sigmoid junction.

REFERENCES.

(1) H. B. Devine: "Colon Surgery in the Debilitated", *The Journal of the College of Surgeons of Australasia*, November, 1928, page 175.

(2) H. B. Devine: "Safer Colon Surgery", *The Lancet*, March 21, 1931, page 627.

SPINAL ANALGESIA: THE "PERCAINE"-EPHEDRINE TECHNIQUE.

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SPINAL analgesia, ever since its introduction in the early years of this century, has been very attractive to some medical minds, the reverse to others. The former are attracted because in this method they have blocking of the trunk of the nerve-tree by a single puncture, instead of the more tedious blocking of several boughs or many fine branches and terminal twigs; the latter shudder at the possible dangers contingent on introducing a powerful drug into the spinal subarachnoid space.

As one who has induced spinal analgesia over two thousand five hundred times in a period of fourteen years, without a death attributable to the anæsthetic, I can say confidently to the fearful that this method is safe, provided meticulous care is taken with the technique. It is not a matter of actual technical difficulty, since the only portion of the whole procedure demanding any skill is the lumbar puncture itself; for the rest, one simply follows the rules. These rules vary according to the authority prescribing them, but, although these rules vary widely, there are certain general principles which must be followed if good results, consistent with safety, are to be realized.

I have always been impressed by the soundness of the principles laid down as early as 1907 by Barker, the first surgeon to introduce spinal analgesia into England; and the reader will see later that, apart from slight modifications, I still follow his general principles of technique.[1] I believe that Barker's principles allow us to combine efficiency of analgesic method with the least disturbance of the very delicate spinal portion of the central nervous system. This delicacy is often taken very little into account, judging by the rather forceful manœuvres of some workers.

Were Barker alive today, he would enjoy his work with spinal analgesia, because two disadvantages from which his, and all other, techniques suffered have in recent years been removed. These were, firstly, the fall in blood pressure inseparable from moderately high and high analgesia, and, secondly, the restricted duration of analgesia.

Blood pressure control has been achieved by the proper use of subcutaneous injections of ephedrine, the alkaloidal principle of Ma Huang, an anciently known Chinese herb, while the long-desired protraction of the length of analgesia has been realized by the use of

"Percaine", a drug of quinoline derivation, introduced by the firm "Ciba" of Basle as a departure from the familiar variations of the cocaine group.

I did not come into contact with "Percaine" till 1931, while on a visit to Europe; but the reports were so favourable that I commenced its use as a spinal analgesic in my own practice at the beginning of 1932, after preliminary experiments with various concentrations and quantities, the former varying from 1 in 500 to 1 in 100. The new drug exerts an analgesic effect in very great dilutions, such as 1 in 2,000 to 1 in 1,000, but I desired to see if success could be obtained by adapting the new drug, as far as the concentration and density of its solution were concerned, to the excellent principles of Barker.

The formula that I finally reached, one which has proved to be quite satisfactory, was a 1 in 200 solution of "Percaine" in a 6% solution of glucose. No more than two cubic centimetres of this solution need be injected, even when high analgesia is desired, so that the principle of a quiet, non-disturbing injection need not be infringed. The addition of glucose in a strength of 6% renders the solution strongly hyperbaric, allowing the employment of the positive gravitational technique of Barker, the specific gravity being 1·024, almost the same as that of the Barker solution of 5% "Stovaine" in a 5% solution of glucose, with which I had done most of my work for the previous twelve years or so.

I shall proceed to describe my technique with this "Percaine"-glucose solution, and then indicate the proper method of using ephedrine to prevent blood pressure fall.

PREPARATION OF THE PATIENT.

It is of high importance to explain to the patient the reasons for using a local instead of a general method, and so to gain his intelligent cooperation; thus is the so-called mental trauma most surely avoided. Even when the patient is very nervous, or actually afraid, at the time of the puncture, it is quite the rule to see his fears vanish when the skin is tested after the onset of analgesia, and he realizes that he will not feel pain. He must, however, be told that he will feel pressure, but he is reassured that he will not experience any pain. It is delightful for the surgeon to know, now that a drug like "Percaine" is available, that this assurance applies to the whole duration of a long operation, instead of only to the first forty to fifty minutes.

Preliminary medication I deprecate for several reasons. I consider that, in my own practice at any rate, mental trauma is best obviated by having the wide-awake intelligent cooperation of the patient. There surely must be very little mental trauma when patients who have had spinal analgesia declare a preference in its favour when a second operation is to be performed. In addition, even though we have a most valuable pressor agent in ephedrine, I distrust any preliminary depressing agent, both for its general depressing effect, and particularly for its possible depressing action on the respiratory centre.

General preparation of the patient is the same as for general anæsthesia, and the dressing covering the prepared skin of the lumbar region should be removable without disturbing the operation field dressing.

THE ANALGESIC AGENT.

The Society of Chemical Industry in Basle (Ciba) has made up for me the special solution of 1 in 200 "Percaine" in 6% glucose described above, and has put it up in ampoules containing three cubic centimetres of the solution. The dose varies from one to two cubic centimetres according to the height of analgesia, and the extra content of the ampoule is merely for the sake of convenience.

Most "Percaine" solutions are made up with very faint acidulation, to prevent precipitation of the "Percaine" base by alkali being slowly dissolved out of the glass. I have found, however, that the solution in ampoules over a year old is quite clear and still adequately analgesic.

INSTRUMENTS.

The original needle used by Barker had the proper short bevel, but was too stout, making too large a hole in the duro-arachnoid. Its great merit was, however, in the notched and blunt-ended cannula, running through the needle and delivering the analgesic solution beyond the point of the needle. This insured accuracy of dosage and certainty of delivery within the theca. Why this combination of needle and cannula is not universally employed I cannot understand, when one considers that instrumental accuracy, even to a millimetre, is absolutely necessary for success.

Elliott Brothers, of Sydney, have made up for me a slender replica of Barker's instrument, the total outside diameter of the needle being only one millimetre (Figure I). Naturally, the

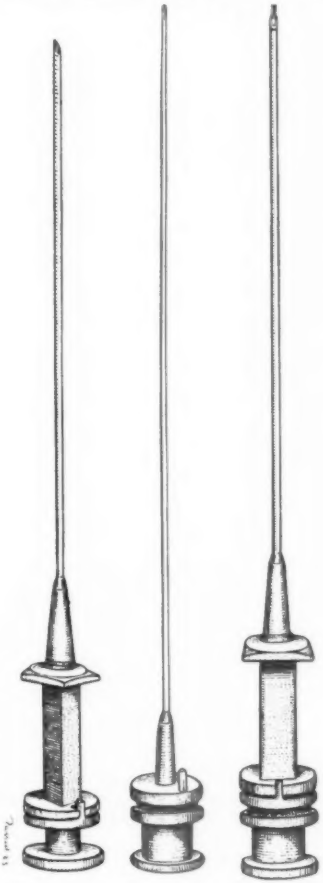


FIGURE I. FIGURE II. FIGURE III.

Figure I.—The lumbar puncture needle with stylette in position. Total diameter of the needle is one millimetre.

Figure II.—Barker's cannula, showing notched extremity.

Figure III.—The lumbar puncture needle, with Barker's cannula in position, showing how the end of the cannula projects one millimetre beyond the tip of the needle.

cannula passing through this needle is very fine, but not too fine to prevent easy aspiration of fluids through it by means of the two cubic centimetre "Record" syringe which is employed (Figures II and III).

STERILIZATION.

All risk of contamination with alkali is avoided by placing syringe, needles, ampoules and files in a small dish containing doubly distilled water. This is brought to the boil from the cold state, and boiling is continued for five minutes. The instruments are then placed on a sterile towel to cool.

THE SPINAL PUNCTURE.

The lateral lumbar puncture position is preferable for inducing abdominal analgesia, the sitting position for perineal. When puncture in the lateral position is difficult, the sitting position is used, but care should be taken to lower the patient into the appropriate posture on his back as quickly as possible after the puncture, to avoid fixation of the hyperbaric solution at too caudal a level.

The cerebro-spinal fluid, which drops slowly from such a fine needle, should appear quite free from blood to the eye, and this clarity should be confirmed when the cannula and syringe are placed in position and aspiration of a few drops of the fluid is made. The appearance of the slightest tinge of blood is an indication for withdrawal of the needle and reinsertion at a different level.

Great care should be taken not to disturb the position of the needle once cerebro-spinal fluid drops from it; when aspiration is made through the cannula, the cerebro-spinal fluid has an oily appearance on contact with the "Percaine" solution. This is a sure sign that the end of the cannula is lying free in the cerebro-spinal fluid. The analgesic is now injected, quietly, but not slowly.

FIXATION POSTURE FOR PERINEAL ANALGESIA.

The fixation posture for perineal anæsthesia is simplicity itself, seeing that the solution we are using is distinctly hyperbaric. The injection is made with the patient in the sitting lumbar puncture position, and he remains sitting for five minutes. After this he may be lowered into any position for operation on all parts supplied by the sacral nerves. After a fixation period of five minutes, even application of the Trendelenburg position will cause only a slight rise above the sacral nerve area.

This particular technique was originally described by me in 1921, this being as far as I know the first time such exact limitation was used.[2] Pitkin, writing in the United States in 1928, described a similar limitation, effected by a more difficult method, and claimed it as original, at least as far as American literature was concerned.[3]

For this purpose, the dose need not exceed 0·7 centigramme (1·4 cubic centimetres of the 1 in 200 solution), though sacral nerve area

analgesia will result from as little as 0·5 centigramme (one cubic centimetre of the solution).

I consider that this variety of spinal analgesia, which has been called intrathecal caudal analgesia, displaces all the various forms of sacral (hiatal) analgesia and parasacral nerve block, because of its facility, invariable complete success and innocuousness.

Should one desire to block the lumbar nerves as well as the sacral, as, for instance, in desensitizing the fundus of the uterus as well as the cervix, the superior wall of the bladder as well as its floor, or in securing analgesia of the lower extremities, one keeps the patient sitting up for only one to two minutes, and then lowers him on to his back, with one pillow under the head. If at the end of five minutes the lumbar nerves

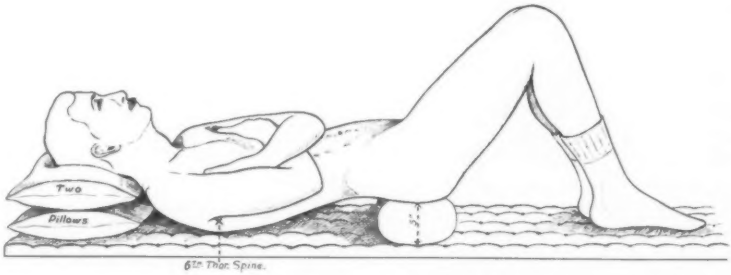


FIGURE IV. Position in which the patient is postured immediately after injection for induction of lower abdominal analgesia.

are not blocked, use a little Trendelenburg position for a few minutes until they are. For lumbo-sacral block I recommend 0·75 to 0·8 centigramme (1·5 to 1·6 cubic centimetres of solution).

FIXATION POSTURE FOR LOWER ABDOMINAL ANALGESIA.

For induction of lower abdominal analgesia the patient is injected in the lateral lumbar puncture position, if possible; when the sitting position has to be used, we should add 0·05 centigramme (0·1 cubic centimetre of solution) of the drug to all doses advised, in order to balance loss of the analgesic in a caudal direction.

In any case, as soon as the injection is performed the patient is made to lie on his back, with two ordinary bed pillows under the head, while a sandbag, 12·5 centimetres (five inches) thick, is placed under the buttocks. It is of the utmost importance that the sandbag should be 12·5 centimetres thick, so that a sufficiently steep slope occurs between the point of puncture and the mid-thoracic region. The position of the patient's body is adjusted so that the bottom of the "vertebral well" is about the region of the sixth thoracic vertebral spine. This "well" is rendered more obvious if a nurse draws the patient's knees up and supports his lower extremities in this position (Figure IV).

At the end of exactly three minutes, the patient's lower extremities are extended, and he is asked to raise them from the table. If he cannot, all is going well; if he can, then he should be placed in a slight Trendelenburg position.

At the end of exactly five minutes, the skin of the lower part of the abdomen is tested by pinching with toothed forceps. The patient is told that he will feel something touch him; he is to state whether the touch is sharp or blunt; in the latter eventuality, analgesia is attained. If the analgesia has not reached the region of the umbilicus by this time, the patient should be placed in a moderate Trendelenburg position to encourage rise of the analgesic level. If the umbilical level, or a higher one, is reached at five minutes from the time of injection, the

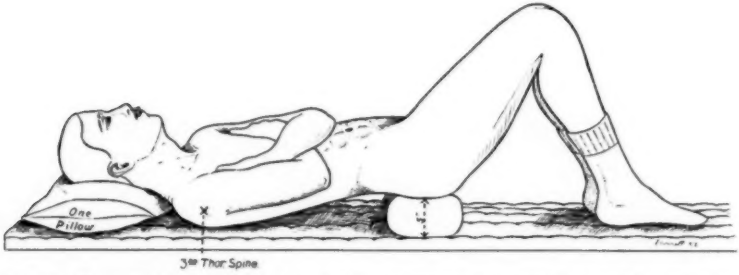


FIGURE V. Position in which the patient is postured immediately after injection for induction of upper abdominal analgesia.

patient may be laid quite flat on the table, and the operation commenced; but it is wiser in this case to defer use of the Trendelenburg position for operation for another five to ten minutes, according to the height of analgesia.

The dose for lower abdominal analgesia is from 0·8 to 0·9 centigramme of "Percaine" (1·6 to 1·8 cubic centimetres of solution), the smaller doses being used, for instance, in small women and in asthenic patients.

FIXATION POSTURE FOR UPPER ABDOMINAL ANALGESIA.

For the induction of upper abdominal analgesia the same routine is followed as in the preceding section, except that the analgesic is made to diffuse to a higher level by making the lowest point of the "vertebral well" at approximately the level of the third thoracic vertebral spine. The same sandbag is used, but only one pillow is placed under the head (Figure V).

Paralysis of the lower extremities should occur in between two and three minutes, and, at the end of five minutes, the analgesia should reach the region of the tip of the xiphoid process. If the analgesia is satisfactory, retain the fixation posture for another five minutes, and,

if analgesia reaches the region of the nipple by this time, operation in the level, gall bladder or kidney position may be commenced. If the rise is insufficient at the end of the first five minutes, the Trendelenburg position must be used at once, moderately, or even steeply, according to requirements.

It is important to emphasize that, once the first five minutes, or "period of fixation", are past, the Trendelenburg position may be used without fear during the next five minutes, or "period of adjustment". Occasionally surgeons who have tried this method have failed to secure sufficient rise in analgesic level. Their injection technique may have been faulty, or the dose too low, but I venture to think that the more frequent reason is an insufficiently thick sandbag in the "period of fixation", or failure to use the Trendelenburg position early enough, or steeply enough, during the "period of adjustment". With proper technique, all patients should be ready for operation in from five to fifteen minutes after the injection.

The dose of "Percaine" for upper abdominal analgesia is from 0·9 to 1·0 centigramme (1·8 to 2·0 cubic centimetres of solution), according to the size and type of patient, always remembering to add 0·1 cubic centimetre of solution where injection has to be made in the sitting position.

For renal operations, approximately the same doses are advisable, but the analgesia need not be encouraged to go so high. Nevertheless, it is no bad thing to reach the nipple level if one wishes to have complete analgesia when the renal pedicle is being pulled on. During the injection the patient should lie on the side of the incision. He is turned on his back, however, immediately after the injection, and postured as described above, but his body may be tilted slightly towards the side of the incision, for it will be remembered that this "Percaine" solution, being hyperbaric, falls in the direction of gravity.

With no method of spinal analgesia is sensation abolished when the diaphragm is directly stimulated by hand movements (phrenic), or when the œsophageal end of the stomach is pulled on (vagus). The surgeon should proceed as gently as possible in these regions, and the administration of a little ethyl chloride or gas and oxygen will make the patient comfortable during this short period.

CONTROL OF BLOOD PRESSURE BY EPHEDRINE.

From a careful study of several hundred sphygmomanometric charts, I have come to certain more or less definite conclusions about the technique of blood pressure control by ephedrine during spinal analgesia.

In the space of this article there is not room to detail these studies. Suffice it to say that their chief outcome is the definite indication to use ephedrine in a routine anticipatory or prophylactic manner, so that blood pressure fall is prevented. Once the pressure has begun to fall, however little the degree is, ephedrine is completely unsatisfactory in ordinary doses, and relatively unsatisfactory even if large doses are

given and repeated frequently. The latter method is obviously an undesirable one.

With sacral and sacro-lumbar nerve area analgesia there is no fall in blood pressure, or exceedingly little, so that no ephedrine is needed, or, at the most, one dose immediately after the spinal injection.

With abdominal analgesia the first dose of ephedrine must be given before the spinal puncture, and, to allow its action full sway before the analgesic paralyses the splanchnic area, it ought to be injected five minutes before the puncture. Rather than give a relatively large dose before the spinal puncture, it was found more efficacious to give a medium dose before and a similar dose as soon as the patient was comfortably postured, that is, about one minute after the puncture. A third, and usually final, dose is injected at a time which depends on the rise of analgesic level. In lower abdominal analgesia the third dose is given when the analgesic level reaches the umbilicus; in upper abdominal, when it reaches the tip of the xiphoid process.

With this routine the average doses are as follows, and the dose is to be repeated as described above. For lower abdominal analgesia, 0·04 gramme of ephedrine sulphate (1·3 cubic centimetres of the 3% solution) for women and small men; 0·045 gramme (1·5 cubic centimetres of 3% solution) for well developed men. For upper abdominal analgesia, 0·05 gramme (1·6 cubic centimetres of the 3% solution) for women and small men; 0·055 gramme (1·8 cubic centimetres of 3% solution) for well developed men.

Some variation from the above routine is advisable in patients with abnormal blood pressure level.

In the case of hypotensive patients, if the arteries are not pumping too strongly when the incision is made, a fourth dose may be given, but not earlier than five minutes after injection of the third dose.

With hypertensive patients, the first dose is not injected until one minute before the spinal puncture, so that any dangerous rise in blood pressure is avoided; in other words, the pressor agent is not given much of a start on the depressing analgesic. The third dose is withheld until incision proves that the arteries are not pumping too strongly, or, acting more exactly, until the sphygmomanometric reading at the time of incision proves that the pressure has not gone up.

By following the above rules, the disturbing and inconvenient use of the sphygmomanometer may be obviated in the great majority of cases. I have always used the subcutaneous method of injection.

ALTERNATIVE "PERCAINE" TECHNIQUES.

I shall mention only two of the commoner methods of using "Percaine" in spinal analgesia in current use in Europe.

Quarella, of Turin, employs a 1 in 200 solution of "Percaine" in 0·9% sodium chloride. The specific gravity is 1·006, and so it is more or less isobaric. Diffusion is not obtained by posture, but by the aspiration and reinjection method called "barbotage". I consider that any

such method is undesirable from its disturbance of the delicate arachnoid mater and unprotected nerves; and Quarella himself reported cases of aseptic serous meningitis, intraspinal hæmorrhage and so on, which worried him into mitigating the severity of his barbotage technique. I would not risk this method.[4]

The other method, one which is apparently much safer, and very favourably received, is that of Howard Jones, of London.[5] Here the solution of "Percaine" is very dilute, being only 1 in 1,500, a strength similar to that used in ordinary infiltration analgesia. Jones's solution is made up with 0·5% sodium chloride, the specific gravity being only 1·003, so that it is definitely hypobaric, and tends to diffuse against the usual direction of gravity. The technique does not depend primarily on diffusion, however, but on the force of direct injection of relatively large amounts of solution, so that analgesia spreads to the umbilicus after the injection of about 10 cubic centimetres, to the xiphoid process with about 12 cubic centimetres, and to the nipples or a little higher with about 16 cubic centimetres.

The method is a kind of reproduction of the tissue infiltration of ordinary local analgesia, and the aim is to mix the weak "Percaine" solution homogeneously with the lumbo-thoracic portion of the column of cerebro-spinal fluid.

Jones considers a great advantage of the weak "Percaine" solution is that sudden absorption of harmful amounts of toxic drug is rendered impossible by the very dilution. This may be, but I have not yet seen a toxic effect with the 1 in 200 solution, except where an assistant inadvertently used a wrong ephedrine technique, and in these cases it was always found that the blood pressure had fallen.

Jones admits that this method is one of "forcible" injection, and so it can in one way be held to be derived from the discredited barbotage technique. At any rate, on the general grounds of avoiding a method which does not fully respect the delicacy of the arachnoid mater and spinal nerves, I feel rather disinclined to use this one, though I applaud the idea of homogeneous infiltration by a very weak analgesic solution.

Howard Jones definitely admits that with hypobaric solutions the danger of respiratory failure is greater than with "heavy" solutions, since, in the supine position, the latter gravitate dorsalwards and block the posterior or sensory roots more than the anterior or motor. The result is that in thoracic analgesia the intercostal muscles are not completely paralysed, and when the analgesic solution accidentally rises into the cervical region the phrenic nerves are likewise only partially affected. Jones is apparently prepared to accept the risk of respiratory embarrassment, but adduces the argument that, in recompense, he secures ideal relaxation of the upper abdominal muscles for stomach and gall bladder operations. I have always found, however, with high abdominal analgesia, using the heavy solution, that the upper portion of the abdominal wall was as soft as butter, even after one and a half to two

hours, and that the patient could hardly, if at all, elevate his ribs with the intercostals.

Nevertheless, Howard Jones must be given great credit for trying to secure uniform blocking of the anterior and posterior roots, even though he has to turn the patient "on the spit" to do it. This refers to what Jones himself calls the "technique of the grill-room chef", that is, turning the patient on to his face for five to ten minutes or more to allow the hypobaric solution to float dorsally and bathe the posterior roots, before finally turning him on to his back to allow blocking of the anterior roots.

Why all this bother, all this undesirable disturbance of the patient, when, in actual practice, the positive gravitational diffusion method secures adequate relaxation of the upper abdominal muscles, and when, moreover, it is realized that full analgesia is a more essential condition of success than full relaxation? Certainly the combination of full analgesia with relative relaxation is a better one than the reverse.

The Howard Jones solution tends to diffuse headwards, so, to counteract this, the patient is placed in a slight Trendelenburg position when he is turned back into the supine posture. This gives a slight caudal trend to the diffusion process.

ANALYSIS OF CASES.

In a little over two thousand five hundred inductions performed with various analgesics there has not been a single death which could by any stretch of imagination be attributed to the spinal analgesia. Before the beginning of 1932 most of these analgesias were induced with "Stovaine"; since then all have been with "Percaine". The solution above described has been used and the results have been all that could be desired.

I do not intend to return to my old ally, "Stovaine", for the simple reason that "Percaine", while just as safe to use, possesses the enormous advantage of procuring prolonged analgesia.

The recent series of "Percaine" cases which I am reporting amount to two hundred and nine, and no ill-effects on the patient, immediate or remote, have been observed.

The series analysed in the accompanying table have been all my own urological cases, but, in addition, I have induced spinal analgesia a number of times in patients of general surgical and gynæcological colleagues, where any form of general anæsthetic has been considered dangerous, and other forms of local analgesia impracticable.

As has been stated, there were no serious after-effects, immediate or remote. Vomiting to a slight degree occurred in some cases, but one can be confident that it will be less with spinal analgesia than with any form of general anæsthesia in a given case. Whenever a patient vomits after spinal analgesia, I question him about previous anæsthetics, and invariably, when he has had a previous anæsthetic, and this has been a general, the vomiting has been far worse.

In two cases in which the analgesia rose to the level of the second thoracic segment, a slight degree of respiratory embarrassment was exhibited. This did not last long, however, and certainly caused no concern.

Headache was not a complication to be feared, as far as my own experience went, any more with "Percaine" than with "Stovaine". Only five patients, that is less than 2%, actually complained of headache, and in two of these cases, both occurring in a public hospital, the patients were allowed up and about against orders on the day following the spinal analgesia. In both of these cases only a low spinal analgesic was induced for cystoscopic examination. In the other three the head-

Table showing Analysis of 209 Cases.

Operation.	Patients' Ages.	Number of Cases.
Nephrectomy	20 to 69	13
Nephrolithotomy	46 to 60	5
Nephropexy	39 to 43	3
Nephrostomy	52	1
Division of aberrant renal artery	53	1
Denervation of renal pedicle	19 to 55	7
Nephropexy and pyelotomy	32 to 50	2
Pyelolithotomy	32 to 56	8
Ureterolithotomy	49 to 69	6
Suprapubic prostatectomy in one stage	54 to 81	49
Suprapubic prostatectomy (first stage)	57 to 83	13
Suprapubic prostatectomy (second stage)	57 to 83	10
Suprapubic resection of median vesical bar	56	1
Suprapubic electro-coagulation and radium implantation in *carcinoma vesicæ*	49 to 69	6
Suprapubic electro-coagulation of multiple *papillomata vesicæ*	25 to 62	7
Permanent cystostomy for carcinoma of the prostate	66 to 78	4
Other vesical operations	54 to 73	2
Litholapaxy	33 to 59	5
Perineal implantation of radium in carcinoma of the prostate	59 to 71	3
External urethrotomy	51 to 54	2
Cystoscopy	7 to 70	42
Cystoscopic electro-coagulation of median vesical bar	41 to 56	5
Cystoscopic electro-coagulation of *papillomata vesicæ*	25 to 62	14
Total cases		209

ache was easily controlled. I have found, for many years past, that headache is best controlled, or rather prevented, by allowing the patient only one pillow for the first day, two for the second and three for the third. He may be propped up in any position on the fourth day, and, when no open operation has been performed, he may leave hospital on the fifth day. I consider this the safest routine.

SUMMARY.

The new local analgesic agent, "Percaine", a derivative of quinoline, may, with advantage, take the place of "Stovaine", "Novocain" *et cetera,* in the induction of spinal analgesia, for, while no more toxic in the doses needed, it opens up a new era in the history of spinal analgesia

by allowing moderately long and long operations to be performed entirely under its effect.

A routine method of employing ephedrine for blood pressure control during spinal analgesia is presented.

A new solution of "Percaine" in glucose is described. The advantage of this solution, which is distinctly hyperbaric, is the possibility of using the principles of Barker in the technique of induction. It is claimed that this technique combines simplicity with least disturbance to the contents of the spinal arachno-dural theca.

REFERENCES.

(1) A. E. Barker: "Spinal Analgesia: Clinical Experiences in 100 Cases", *The British Medical Journal*, March 23, 1907, page 665.

(2) R. J. Silverton: "Spinal Analgesia in Urinary Surgery", *The Medical Journal of Australia*, Volume I, 1921, page 475.

(3) A. P. Pitkin and F. C. McCormack: "Controllable Spinal Anæsthesia in Obstetrics", *Surgery, Gynecology and Obstetrics*, 1928, Volume XLVII, page 713.

(4) B. Quarella: "The Advantages of Percaine in Spinal Anæsthesia", *Minerva Medica*, Volume II, 1930, page 325.

(5) W. Howard Jones: "Spinal Analgesia: A New Method and a New Drug, Percaine", *British Journal of Anæsthesia*, Volume VII, April, 1930, page 99; and July, 1930, page 146.

ANÆSTHESIA.[1]

By GEOFFREY KAYE,
Melbourne.

ALLOW me to express my appreciation of the honour done me in the invitation to address you this evening. I understand that the main purpose of my address is to excite discussion, and this may best be done by reviewing briefly a wide range of anæsthetic problems. I shall present little that is original, but shall confine myself to giving an individual anæsthetist's impressions of modern anæsthesia.

THE SAFETY OF ANÆSTHETICS.

An anæsthetic, and especially a general anæsthetic, is expected to abolish appreciation of pain, to render the patient quiescent, and to diminish reflex activity so as to insure muscular relaxation sufficient for the surgeon's needs. No drug can yet produce these profound physiological changes without risk of injury to the patient. As Killian, the German anæsthetist, tersely remarks: "Every narcotic is a poison." If we must use a poison, we require that it shall adequately depress the sensory cerebral cortex, but that it shall exert a minimum of depressant action upon the medullary vital centres and a minimal toxic effect upon the heart, the liver and the kidneys. We choose, therefore, drugs in which the margin between the desirable and undesirable pharmacological effects is relatively wide, and we must remember that this margin becomes reduced in states of toxæmia, anoxæmia or shock. Since we cannot forecast how a given patient will react to a stated dose of the chosen drug, we should select drugs of which the administration may be suspended should ill-effects ensue.

No critical figures exist for the safety of the different anæsthetics. It is useless to state, as is sometimes done, that the mortality under ether is one in 16,000 and under chloroform one in 4,000 cases. These figures take no account of the nature of the operation or the gravity of the anæsthetic risk. To obtain critical figures, one would need to take, for example, one thousand patients of a given degree of anæsthetic risk upon whom the operation of cholecystectomy was performed under ether anæsthesia. The same operation would require to be done upon another thousand patients of similar anæsthetic risk, but under ethylene anæsthesia. The two anæsthetics might be then reasonably compared as to mortality. No such critical figures have appeared to my knowledge, and an attempt to obtain them at our hospital in 1932 failed because

[1] Read at the annual meeting of the Royal Australasian College of Surgeons on April 12, 1933.

inexperienced anæsthetists were apt to over-rate the gravity of the risk in given cases. For the present, then, our conception of the safety of different anæsthetics must remain largely a clinical impression.

The anæsthetic risk, in a given patient, will depend upon that patient's anæsthetic tolerance in general and in particular upon the nature and length of the proposed operation and the degree of shock and trauma so produced, upon the dexterity of the surgeon, upon the toxicity of the anæsthetic and the skill of the anæsthetist. Each of these factors should be assessed with care by both surgeon and anæsthetist, working in close collaboration. Various numerical formulæ have been devised, such as Moot's index (that is, pulse pressure × 100 ÷ diastolic pressure = 50, approximately, in normal subjects), in an attempt to express anæsthetic tolerance in terms of a mathematical equation. Though often helpful, numerical formulæ do not always accord with the clinical findings, in which case the judgement of the trained clinician should be preferred to the formula. Finally, having estimated the anæsthetic tolerance of the patient, the surgeon should be content to limit the scope of the operation to what that patient might reasonably endure. Thus it may be preferable to perform thyreoidectomy in two stages rather than to jeopardize the life of the patient by attempting too much at a single operation.

THE CHOICE OF THE ANÆSTHETIC.

The choice of the anæsthetic is made from the dual standpoint of safety and convenience. Should they conflict, safety must always come first. The anæsthetic having been chosen, the surgeon may be much assisted by judicious choice of the actual technique of administration.

The local anæsthetics are, of course, the safest, and should be preferred unless undesirable for technical or psychological reasons. Even local anæsthetics are not without toxicity, and deaths have attended their use. Cocaine, the worst offender in this respect, has been rightly restricted in its applications. "Percaine" has lately incurred suspicion, and I am aware of instances where death followed its use as a local anæsthetic. Ethocaine, best known under its trade name of "Novocain", would seem to be the safest of the group.

It is unnecessary to summarize for the present audience the advantages, disadvantages and contraindications of ether. It is likely to remain the "standard" anæsthetic in this country for years to come, and is certainly the anæsthetic best suited to the non-specialist anæsthetist. The use of carbon dioxide in the induction of ether anæsthesia has lately attracted so much attention as to merit comment. Its safety, in my opinion, is comparable with that of the ethyl chloride-ether "sequence". Reference to Figure I will show the profound stimulation of the respiratory centre resulting from inhalation of carbon dioxide, and it will be seen how readily over-stimulation might result from overdose. If the inexperienced anæsthetist be liable to produce embarrassment of the heart by overdose of ethyl chloride, he is no less liable to produce over-stimulation and serious fatigue of the respiratory centre by overdose

of carbon dioxide. The concentration of this gas in the inspired air should rarely exceed 5%, and certainly not exceed 10% for more than a few moments. Personally, I believe that the ethyl chloride induction is pleasanter for the patient than is the carbon dioxide-ether induction, though I am aware that some of my colleagues might differ. In approximately 100 cases of each, I was able to find no material difference in the amount of post-anæsthetic vomiting following the two techniques.

Chloroform, however agreeable to the surgeon, has rightly fallen into disfavour. Apart from the classic risk of cardiac syncope during induction, chloroform is too depressing to the circulation for routine

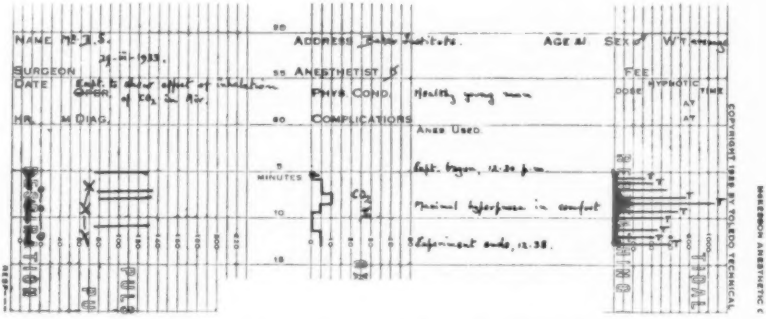


FIGURE I. Effect of inhalation of carbon dioxide on lung ventilation (McKesson "Nargraf" record). The subject breathed air containing various percentages of carbon dioxide. The pressure of delivery of the mixture is recorded on the extreme left of the chart. The adjacent interrupted line shows the respiration rate. The crossed interrupted line indicates the pulse rate. The horizontal lines show the blood pressure, the systolic value being on the right and the diastolic on the left. In the centre of the chart is recorded the percentage of carbon dioxide. At the right of the chart are a series of readings of tidal capacity of the lungs. It will be seen that inhalation of carbon dioxide in percentages up to ten produced progressive increases in lung ventilation, which rose from three hundred cubic centimetres at the start to over a litre when 10% carbon dioxide was being inhaled. No change was produced in the rate of pulse or respiration, or in the blood pressure.

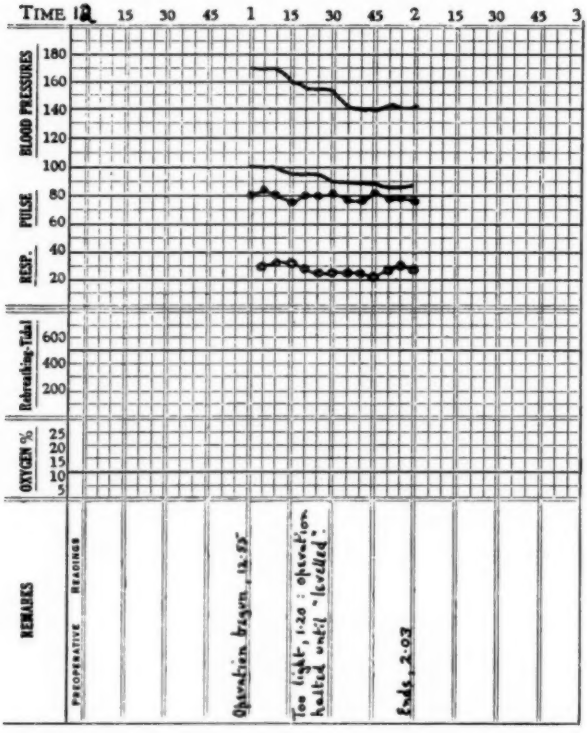
use. In Figure II is exemplified its tendency to depress the blood pressure even in an otherwise uncomplicated case free from operative shock. Chloroform, moreover, is highly toxic to the liver, and is contra-indicated in cases of hepatic insufficiency or acidosis, and in patients of grave anæsthetic risk. It still retains a place in the anæsthetist's armamentarium, but the place is a limited one.

The gaseous anæsthetics are ideal from the patient's standpoint, because of their pleasantness, their freedom from toxicity to the heart or vital organs, their speedy elimination and their very slight tendency towards after-sickness. Their use is, however, restricted in this country by economic factors. From the surgeon's standpoint, relaxation is less perfect than with ether. Adequate premedication, accurate administration, efficient apparatus and the judicious use of ether supplement do

No. E.W.E. 23. **Anesthetic Record** Age 48.

Surgical Risk A B C D — B Sex ♂ Wt. 9st 7oz 6

Physical Appearance, General Rather toxic. Facial Expression drawn.
Physical Conditions normal except Chr. pulmonary fibrosis. Copious white sputum ; weak heart sounds ; no gross physical signs in chest. GAS ANAESTHESIA UNOBTAINABLE.
Operation Radical Mastoid. Time Began 12.40 p.m.
Preanesthetic Hypnotic Atropine. Dose gr. 1/100. Time of Admin ?
Anesthetic C-E, 1:1 Total Quantity 4 oz. Technic Junker.


TIME 12 15 30 45 1 15 30 45 2 15 30 45 3
BLOOD PRESSURES 180 160 140 120 100
PULSE 80 60
RESP. 40 20
Rebreathing-Tidal 600 400 200
OXYGEN % 25 20 15 10 5
REMARKS
PREOPERATIVE READINGS
Operation begun, 12.55
Too light, 1.20 : operation halted until "levelled".
Ends, 2.03

Operative Complications Affecting Anesthetic or Convalescence Uneventful.

Degree Circ Depression During Operation 1st ✓ 2nd 3rd — end 1st ✓ 2nd ↓ 3rd

FIGURE II. Normal chloroform anæsthesia. The two continuous lines indicate the systolic and diastolic blood pressure respectively. The upper interrupted line records the pulse rate and the lower the respiration rate. A fall in blood pressure, especially the systolic pressure, is indicated.

much to overcome this drawback. Ether supplement is rarely contra-indicated and (since the amount of ether may amount only to an ounce or less, distributed over an administration lasting an hour) does not materially affect such considerations as liver function or post-anæsthetic vomiting. I notice that more or less ether supplement was required in 21 of 37 cases of abdominal section under gas anæsthesia, and in but 12 of 69 extraabdominal operations. From the anæsthetist's standpoint, gaseous anæsthetics have the drawback that satisfactory anæsthesia lies in a relatively narrow zone between inadequate relaxation on the one hand and anoxæmia on the other. Kept in that zone, the gases are probably the safest of general anæsthetics. The inexperienced anæsthetist may fail to keep within the bounds, and is then liable to encounter either protests from the surgeon or alarming signs from the patient. For this reason, I would advocate ether for any anæsthetist not prepared to make a study of the gas anæsthetic technique, and for any surgeon who insists upon complete relaxation at any price.

I am becoming doubtful of the value of gas anæsthesia in routine surgery of the nose and throat. Agreeable as it is for the patient, it introduces technical difficulties for both surgeon and anæsthetist. In certain cases, as of pulmonary or cardiac disease, the choice of endotracheal gas anæsthesia becomes obligatory if general anæsthesia is to be employed. In routine healthy patients, however, endotracheally administered ether is perhaps the anæsthetic of choice. The frequently adopted compromise of using gaseous anæsthetics with almost continuous ether supplement, vitiates, to my thinking, most of the advantages of gas anæsthesia.

In passing, I would draw the attention of oral surgeons to that form of endotracheal ether anæsthesia which requires the use of a wide bore rubber catheter fitted with an exhalation valve. Anæsthesia is smoother, and at the same time lighter, than where a small catheter and an insufflational technique are employed. The airway is kept patent, whilst the operating field is free from escaping ether vapour. Finally, by packing the pharynx around the catheter, the larynx can be protected against entry of foreign matter.

Reverting to gas anæsthesia, I do not regard the choice between ethylene and nitrous oxide as very material, provided that the apparatus be efficient and accurate. In that case, the greater relaxation claimed for ethylene does not impress me as considerable. Nitrous oxide is rather less depressing, whilst ethylene is definitely easier to give. On the whole, I would as soon use one gas as the other, remembering always that ethylene is highly explosive in the presence of the cautery or diathermy, whilst nitrous oxide is not, unless it be admixed with ether.

I have been accused of undue enthusiasm for gas anæsthesia, but I value its freedom from visceral intoxication no less than its safety on the operating-table. I do not expect the present audience to dispute the value of gaseous anæsthetics, especially in cases of grave anæsthetic risk.

PREMEDICATION.

Adequate premedication secures physical and mental rest for the patient, favours better anæsthesia subsequently and reduces the amount of anæsthetic required. The barbituric acid derivatives and "Avertin" have the added advantage of protecting the patient against the toxic action of the drugs used in regional and spinal anæsthesia.

Unfortunately, the patient's response to a given dose of any sedative cannot be predetermined. A dose inadequate for one individual may produce profound narcosis, with depression of respiration and circulation, in another. One endeavours, therefore, to employ drugs of relatively uniform action in doses which will do no harm even should hypersensitivity exist.

Before giving ether, and especially before giving chloroform, I prefer light sedation, because ether and chloroform are themselves respiratory depressants. Chloretone or, in more nervous subjects, a barbiturate such as "Sodium Amytal" is my usual choice. Before gas anæsthesia deeper sedation is possible, because by rebreathing the respiration can be kept under some control and because the gaseous anæsthetics are not respiratory depressants unless associated with anoxæmia. In gas cases, therefore, I use "Sodium Amytal" or "Nembutal", combined with small doses of morphine. The use of morphine and hyoscine impresses me as less reliable. The combination of morphine and a barbiturate, in slightly larger doses, is desirable before regional or spinal anæsthesia, the barbiturate having also a detoxicating effect on the local anæsthetic.

BASAL NARCOSIS.

Basal narcosis evolves out of premedication, conferring on the patient actual oblivion of the events immediately preceding and succeeding the operation. This real boon must be bought at a price, and the price is the risk of respiratory and circulatory depression. No basal narcotic yet known is free from depressant action upon the medulla. Calculation of the dose from the patient's weight is no absolute safeguard, because it neglects personal susceptibility. Once the drug has been given, it cannot be withdrawn should ill-effects supervene: one can only adopt measures of stimulation until the drug has been spontaneously detoxicated and eliminated.

Of basal narcotics, "Avertin" claims first mention. I visited Germany primarily to see "Avertin" employed, and I have had little inclination to use it since. It must be realized that its use as an anæsthetic has been abandoned, and that even in Germany it is employed as a basal narcotic alone. Its effects are inconstant, some patients showing restlessness and some over-deep narcosis. Respiratory depression is frequently in evidence, and the deaths under "Avertin" have been in the main attributed to this cause. "Coramine" and ephedrine have been proposed as antidotes, and oxygen and carbon dioxide (by the endotracheal route if necessary) have been recommended in treating the respiratory depression. One feels that "Avertin" is unsuited for routine

use, since it is too toxic to be injected into the rectum in a way which releases it from direct control. It has, in all probability, its uses, as in patients whom, owing to thyreotoxicosis or extreme terror, it would be undesirable to bring to operation in a conscious condition. The rectal administration of paraldehyde, of which I have had as yet no experience, has been recently much advocated. Paraldehyde, like all other anæsthetics, has been associated with fatalities, but it is claimed that the margin between the narcotic and the toxic doses is wider than in the case of "Avertin".

Though I have seen intravenously induced anæsthesia with the barbiturates, I have not yet found occasion to employ it. I confess to a prejudice against injecting into the circulation potent drugs which cannot be withdrawn or controlled, and of which the full effects may be manifest only after the injection has been completed.

The whole topic of basal narcosis is *sub judice*. The method has great advantages, but it implies a surrender of control over drugs which are too toxic to be safe. In gas anæsthesia one can cease to administer the gas and can give oxygen: then, in relatively few breaths, all the gas will be eliminated from the body. One cannot so readily terminate the action of the basal narcotics. It is possible that some form of basal narcosis may be the technique of the future, but, before this can be, we must discover a drug which is either wholly free from toxicity or which possesses an effective antidote. Until then, whilst according to basal narcosis a place in one's armamentarium for selected cases, I prefer to employ in general lighter sedation and a main anæsthetic capable of direct control.

SPINAL ANÆSTHESIA.

Spinal anæsthesia is a debatable field, in which the literature is singularly contradictory and in which my personal experience has been small. I propose to discuss not the recognized advantages of the method, but the circulatory depression which is its danger. An instance of such depression is given in Figure III. I have had some gratifying results from spinal anæsthesia and some grave anxiety. Despite every recommended precaution as to posture, the use of ephedrine and the giving of carbon dioxide and oxygen, I have at times encountered that alarming fall in blood pressure. Some writers regard this with equanimity, but not I, because patients do at times succumb under spinal anæsthesia and apparently from circulatory depression. The mortality is variously stated in the literature, individual reports ranging from one in 250 to one in 11,000, but it seems accepted that "high" spinal anæsthesia carries a greater risk than "low". Work recently published places the incidence of post-operative respiratory sequelæ as much the same after spinal as after ether anæsthesia.

Apart from such recognized contraindications as vascular hypertension, neurological disease or syphilis, I believe spinal anæsthesia to be contraindicated in gravely ill or shocked patients. I am aware that

No. A.H. 409. **Anesthetic Record** Age 24.

Surgical Risk { A ___ B ___ C ✓ D ___ } Sex ♂ Wt. Large.

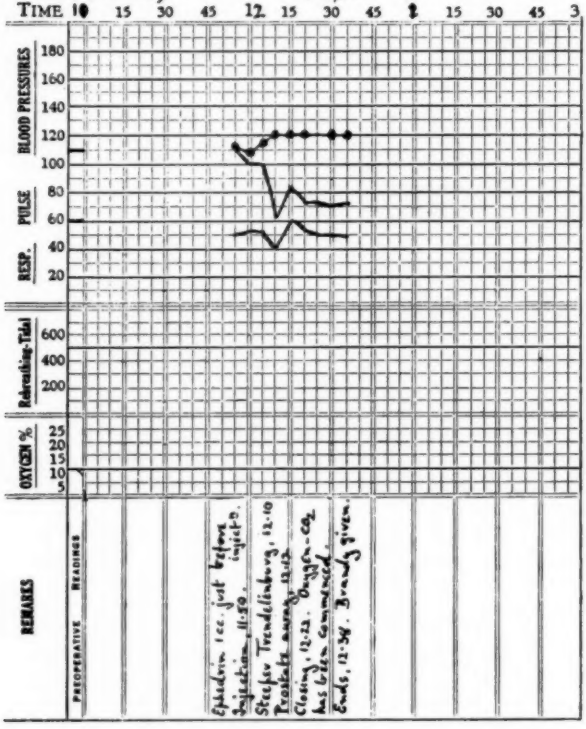
Physical Appearance, General Fairly healthy. Facial Expression ___

Physical Conditions normal except Blood Urea .70. U.C.T. 1.3%. U.C.F. 20. General condition fair, though rather enfeebled.

Operation PROSTATECTOMY. Time Begun 11:50 a.m.

Preanesthetic Hypnotic Na Amytal. Dose gr. 3. Time of Admin 1m x a.m.

Anesthetic SPINAL. Total Quantity 1.5 cc. Technic erect position. (Ethocaine). of 8%.


TIME 10 15 30 45 12 15 30 45 1 15 30 45 3
BLOOD PRESSURES 180 160 140 120 100
PULSE 80 60
RESP. 40 20
Rebreathing-Tidal 600 400 200
OXYGEN % 25 20 15 10 5
REMARKS
PREOPERATIVE READINGS
Epidrin 1 cc. just before injection, 11:50.
Stofair Trendelenburg, 12:10
Prostate away, 12:12.
Closing, 12:23. Oxygen etc. has been commenced.
Ends, 12:34. Brandy given.

Operative Complications Affecting Anesthetic or Convalescence ___

No vomiting — no respiratory sequelae nor headache.

Degree Circ Depression During Operation { 1st ___ 2nd ___ 3rd ✓ } end { 1st ___ 2nd ___ 3rd ✓ }

FIGURE III. Spinal anæsthesia. Circulatory depression. The two continuous lines indicate the systolic and diastolic blood pressures respectively. The interrupted line records the pulse rate. A sharp fall in blood pressure is recorded, although the pulse rate does not rise greatly.

until recently it was for those very patients that spinal anæsthesia was advocated, but I believe that attitude to have been quite erroneous. The death in our hospital recently of a patient suffering from acute peritonitis, within a few minutes of an intrathecal injection of "Percaine", has not lessened this conviction. Incidentally, I consider it undesirable for the surgeon to employ spinal anæsthesia when operating alone. The patient should receive the constant attention of a skilled assistant familiar with the signs and treatment of the respiratory and circulatory ill-effects which may occur.

Spinal anæsthesia, like basal narcosis, is in a state of flux. It has its uses, such as for very robust patients difficult to anæsthetize satisfactorily by other methods, or for very distended but not otherwise enfeebled patients suffering from intestinal obstruction (Coates). I am not tempted to employ it as a routine. I should not choose it for myself were I to undergo operation, and I would ask my audience, when they discuss the subject, to apply the same criterion.

RESPIRATORY SEQUELÆ.

Post-anæsthetic respiratory sequelæ fall into three groups. The first comprises cases in which the anæsthetic has been unsuitably chosen, for example, ether in a case of tuberculosis or lung suppuration. In the second, foreign material (as contaminated blood, pus, vomitus, tonsillar tissue or teeth) has been allowed to enter the bronchial tree during the anæsthetic or in the recovery period. This may be obviated by sound anæsthetic technique, such as endotracheal administration where indicated. Equally important is supervision of the recovery period, which is too often neglected by the surgeon and anæsthetist and left to the most junior nurse available. The third group of respiratory sequelæ is atelectatic in origin. As a result of diminished lung ventilation (whether from anæsthetic overdose, excessive premedication, trauma to the diaphragm, post-operative pain, or undue recumbency), a minor bronchus becomes occluded by mucus. The area of lung behind the obstruction becomes atelectatic and collapses, and autogenous infection completes the picture. Both anæsthetist and surgeon should be on their guard against factors likely to promote atelectasis. Periodic post-operative inhalations of 5% or 10% mixtures of carbon dioxide in oxygen should be instituted in any case in which anxiety is felt for the lungs, and ideally should be the routine after all operations.

Actually, we are fortunate in Australia in having rather a low incidence of post-operative respiratory sequelæ. In Table I details are given of 1,100 personal administrations of general anæsthetics, with seven cases of post-operative bronchitis or pneumonia, one proving fatal. It will be seen that, with one exception, each case was associated with a definite and avoidable error in anæsthetic or surgical technique. The climatic factor was unimportant, since no case occurred in the winter time.

VOMITING.

Post-operative vomiting is increased should the patient show any tendency towards acidosis. Rigorous pre-operative starvation is to be deprecated: a light meal should be permitted on the evening before operation, and glucose given freely up to four hours before the induction of anæsthesia. As glucose is sickly to many patients, loaf or barley sugar may be substituted. Ether and chloroform produce demonstrable impairment of liver function and (the latter especially) are contraindicated in cases of hepatic insufficiency and of diabetic or other acidosis. The gaseous anæsthetics, which do not affect the liver, are preferable. The diabetic patient should receive a sufficiency of insulin (not less than twenty units) two hours before operation, "buffered" with glucose in the ratio of three grammes to the unit of insulin.

In Figure IV is presented an analysis of post-operative vomiting in 400 personal cases. It will be seen that one-fifth of the patients who

TABLE I.—SHOWING RESPIRATORY SEQUELÆ IN 1,115 ADMINISTRATIONS.[1]

Anæsthetic.	Cases.	Respiratory Sequelæ.
Ether	806	3
Nitrous Oxide	213	2
Ethylene	73	2
Others	23	—
Total	1,115	7

[1] Reasons for sequelæ:

1. Faulty Choice of Anæsthetic: Ether having to be used in two cases better suited to gas anæsthesia.

2. Technical Errors: (*a*) Too small a catheter in a case of tonsillectomy under endotracheal ethylene; (*b*) premature removal of pharyngeal packing in a case of laryngectomy under endotracheal nitrous oxide. Fatal pneumonia.

3. Various: (*a*) Prolonged recumbency after ether for operation on forearm; (*b*) soreness of costal margins after local infiltration in abdominal operation under nitrous oxide *plus* novocain; (*c*) unexplained, following tonsillectomy under endotracheal ethylene.

received ether escaped without vomiting, whilst three-fifths had relatively slight vomiting. Of those who received gas anæsthesia, three-fifths had no vomiting at all, and one-fifth had slight vomiting, usually slighter than was the case after ether. So far, then, the superiority of gaseous anæsthetics is clearly demonstrated. The incidence of moderate and severe vomiting was, however, almost identical in both series, suggesting that these may be due to factors other than the anæsthetic, such as operative trauma, personal susceptibility *et cetera*.

As a profession, we are inclined to regard post-anæsthetic vomiting too much as a necessary evil. In view of its importance from the patient's standpoint, its incidence and prevention would repay further study.

THE PRESENT STATUS OF THE ANÆSTHETIST.

It is charged against the modern anæsthetist that he regards the patient rather as a subject for anæsthesia than for surgery. This may be partly true, but it is a reaction against that not-distant era when the anæsthetist was held to be a necessary nuisance, a person who would keep the patient quiet whilst the surgeon operated. The safety of the

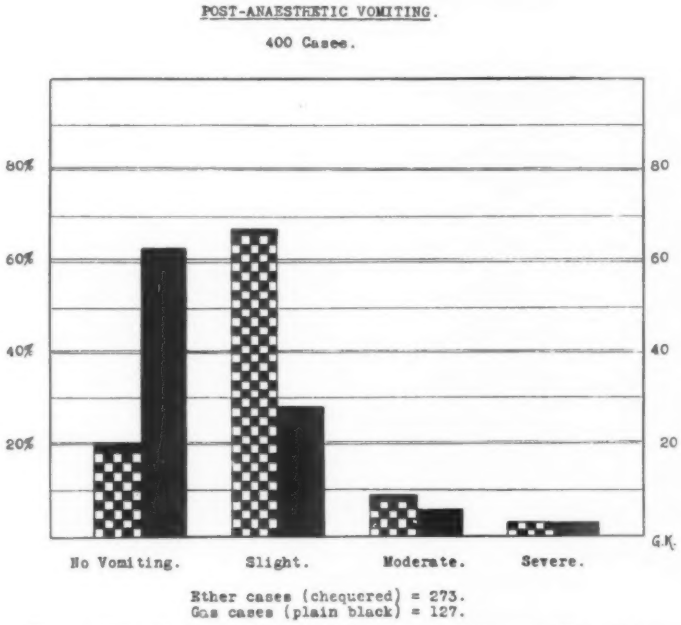


FIGURE IV. Post-anæsthetic vomiting. It will be seen that post-anæsthetic vomiting is in general much less after the gaseous anæsthetics than after ether. Moderate and severe vomiting are, however, much alike in the two series, suggesting perhaps that in such cases the vomiting may be due to causes other than the anæsthetic.

patient was almost subordinated to his immobility. The modern anæsthetist tries to do more for his patient than this, and it is important that he and the surgeon should agree upon the duties and responsibilities of each.

The anæsthetist should endeavour to visit his patient on the day before operation, to examine him in no cursory fashion, to prescribe premedication and to decide on the safest and most convenient anæsthetic by consultation with the surgeon. At the operation he should adopt such technique as will best assist the surgeon. He should keep close watch on the patient's pulse rate, respiration rate, blood pressure

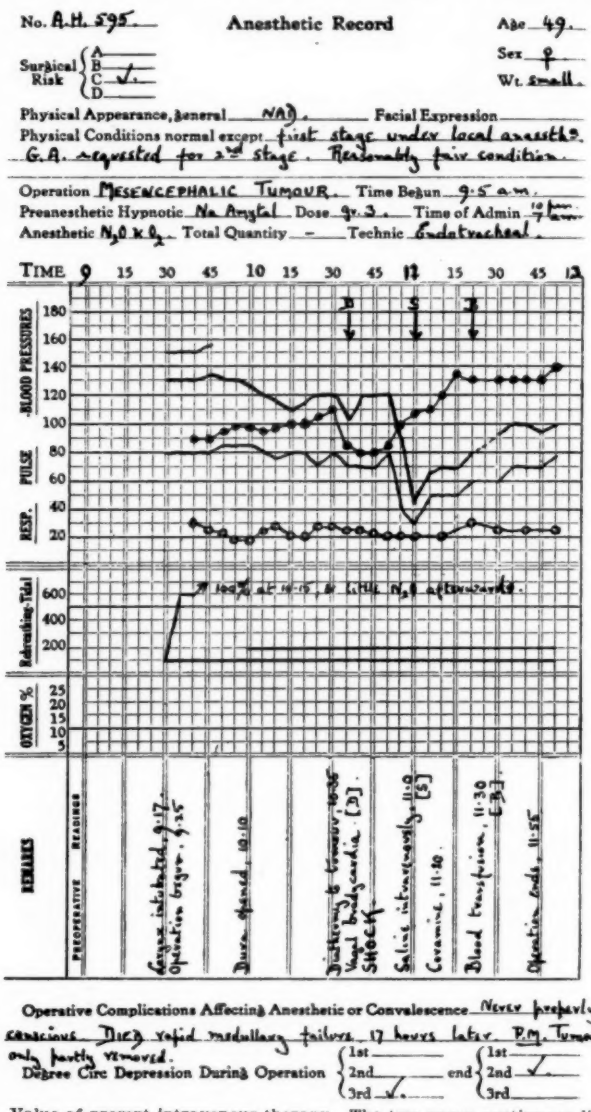

No. A.H. 595.
Anesthetic Record
Age 49.
Surgical Risk A B C ✓ D
Sex ♀
Wt. small.
Physical Appearance, General NAD. Facial Expression
Physical Conditions normal except first stage under local anaesth?
G.A. requested for 2nd stage. Reasonably fair condition.
Operation MESENCEPHALIC TUMOUR. Time Begun 9·5 a.m.
Preanesthetic Hypnotic Na Amytal Dose gr. 3. Time of Admin 10 p.m. 7 a.m.
Anesthetic N2O & O2 Total Quantity – Technic Endotracheal.
TIME 9 15 30 45 10 15 30 45 11 15 30 45 12
BLOOD PRESSURES
PULSE
RESP.
180 160 140 120 100 80 60 40 20
Rebreathing-Tidal
600 400 200
100% at 10·15, & little N2O afterwards.
OXYGEN %
25 20 15 10 5
REMARKS
PREOPERATIVE READINGS
Gauze inhaled, 9·17. Operation begun, 9·35
Dura opened, 10·10
Diathermy & tumour, 10·35. Vagal bradycardia [D]. SHOCK
Saline intravenously, 11·0 [S]
Ceramide, 11·20
Blood transfusion, 11·30 [B]
Operation ends, 11·55
Operative Complications Affecting Anesthetic or Convalescence Never perfectly conscious. Died rapid medullary failure 17 hours later. P.M. Tumour only partly removed.
Degree Circ Depression During Operation 1st 2nd 3rd ✓ end 1st 2nd ✓ 3rd

FIGURE V. Value of prompt intravenous therapy. The two upper continuous lines indicate, as before, the blood pressure. The upper interrupted line shows the pulse rate, the lower the respiration rate. The two parallel lines at the bottom of the chart show the tidal capacity of the lungs and the volume of anæsthetic mixture rebreathed at each respiration. The adjacent climbing line indicates the oxygen percentage in the anæsthetic mixture. The chart shows a fall in blood pressure and a slowing of pulse rate at the point marked D, where diathermy was employed in the medullary region. True shock, with catastrophic fall in blood pressure and rise in pulse rate, soon followed. The benefit obtained by intravenous infusion of saline solution (S) and of blood (B) is well illustrated.

and colour and (whilst not harassing the surgeon with too many comments) should immediately report any untoward event. His observations should enable him to assist the surgeon in deciding whether further operative procedures will be tolerated by the patient, for example, removal of the second lobe during thyreoidectomy. He should suggest and supervise the administration of stimulants, including intravenous infusion of blood or saline solution, should such become necessary. The value of a well-timed infusion will be seen from Figure V.

The surgeon, on the other hand, should exercise cooperation. He should not demand too much when the anæsthetist is in difficulties with a sick patient, and he should give due warning when extra muscular relaxation is required. If a surgeon exerts sudden traction upon the mesentery when the patient is under light anæsthesia, he should not blame the anæsthetist if the patient shows signs of resentment. The surgeon is frequently a worried man, but he should not indulge in compensation-behaviour at the expense of the anæsthetist, who is doing his best and who has often troubles of his own.

After the operation, the anæsthetist should visit the patient in bed that obstruction to the airways or insufflation of vomitus may be prevented. Finally, he should again visit the patient on the day after operation that hyperemesis or respiratory sequelæ may receive attention.

In hospital work, at least, the anæsthetist can perform other duties. He can undertake some of the regional anæsthetic procedures, giving injections to successive patients for the surgeon's convenience. He can and should undertake all oxygen and carbon dioxide therapy required by the surgical team. Since in this country the anæsthetist usually doubles the rôles of anæsthetist and physician, he should be prepared to act at need as physician in the surgical team and as liaison officer between the medical and surgical services of the hospital.

I do not regard this conception of the anæsthetist's duties as idealized. It presents a standard which has been attained in other lands, and one to which Australian anæsthetists, however imperfectly, are aspiring.

GYNÆCOLOGICAL ANÆSTHESIA.[1]

By J. M. BUCHANAN,
Melbourne.

THE question of the most suitable anæsthetic agent for use in gynæcological operations raises the question of what precisely should be the most desirable elements of the resulting anæsthesia. For those patients submitted to abdominal section, a method should be selected which will produce perfect abdominal relaxation, thus allowing the intestines and upper abdominal viscera to fall upwards out of the pelvic area when the patient is placed in a full Trendelenburg position. Patients requiring various types of perineal operations are undoubtedly aided in their post-operative course if there is a minimum of pain and straining during retching immediately following operation.

Quite possibly general anæsthesia under the control of an expert anæsthetist would provide these desiderata. However, the experience of anæsthetists varies, and there are undoubtedly some persons in whom anæsthesia has to be pushed to a dangerous depth before an entirely adequate abdominal relaxation is obtained.

At the service of the gynæcological surgeon, and ideally adapted to the area in which the work is undertaken, is spinal anæsthesia, and it is of this type of anæsthesia in particular that the following remarks are made.

There is no doubt that spinal anæsthesia has been slow to progress in the hands of others than the Continental surgeons. This, I think, is due to several factors, namely, the natural fear engendered by reports of failures and even of fatalities when unsuitable drugs and inadequate technique were employed in early cases; failure to secure anæsthesia by surgeons who do not use this method as a routine measure and who draw conclusions from a small number of cases; and, lastly, but probably not least, the inherent conservatism of the Anglo-Saxon race.

We have now observed over 1,400 inductions of spinal anæsthesia and are quite convinced that with suitable drugs and adequate technique the method is ideal for any surgical procedure below the umbilicus. It is true that surgical anæsthesia can be induced as far as the costal margin, but it is not as yet entirely certain, and, therefore, not recommended.

[1] Read at the Annual Meeting of the Royal Australasian College of Surgeons on April 12, 1933.

CONTRAINDICATIONS.

There are definite contraindications to this method which must never be overlooked. Spinal anæsthesia must never be used in the presence of an acute inflammatory process anywhere in the body. To do so is to court disaster. It is also unwise to use it when the patient is exsanguinated, especially if the hæmorrhage has been rapid. The small but definite fall in blood pressure resulting from the induction of anæsthesia may be sufficient to turn the scale against the sufferer. Incidentally, there is no doubt in our minds that women are more satisfactory subjects for spinal anæsthesia than men.

ADVANTAGES.

The advantages of spinal anæsthesia are that, despite statements to the contrary, it is the safest anæsthetic for patients suffering from cardiac and respiratory disorders or in diabetic subjects. In extensive operations, such as Wertheim's hysterectomy, there is a distinct diminution in the degree of surgical shock. Provided the proper pre-operative medication is administered, there is complete amnesia on the part of the patient and from the purely surgical standpoint the complete muscular relaxation renders the operative work very much easier.

From the patient's point of view, with the drugs that we are using at present, there are, apart from anæsthesia, about eight hours of post-operative analgesia, which is very comforting; and in many cases there is no post-operative vomiting at all.

Elderly people stand this form of anæsthesia very well indeed.

DISADVANTAGES.

There are undoubtedly some minor disadvantages associated with spinal anæsthesia.

In the first place, a varying proportion (2% to 3%) of inductions are unsatisfactory in their results; usually this is due to inadequate spinal puncture, but it occasionally follows what is apparently a perfectly satisfactory injection. The blood pressure certainly falls following the incidence of anæsthesia, but with the use of ephedrine this fall is rarely more than twenty millimetres of mercury. It does not affect the general condition of the patient, and we are convinced that the dangers of this phenomenon have been vastly overrated. Owing to the preliminary morphinization of these subjects, the respirations are often slow, but the colour remains uniformly good, and no disquiet need be felt upon that score.

Post-operative headache undoubtedly occurs in a definite proportion of cases. It is rarely so severe (3%) that the patients complain, though a fair proportion (30%) will admit to a headache if definitely questioned regarding it. Seldom does the phenomenon last more than twenty-four hours, and dosage with aspirin, phenacetin and caffeine is usually sufficient. It is nearly always associated with "double" punctures of the *dura mater* during the operation of injection.

DRUGS.

The most satisfactory drugs for use in spinal anæsthesia are "Novocain" 160 milligrammes, or "Percaine" (Ciba) 10 milligrammes. Both are certain and apparently quite safe. "Spinocain" is definitely dangerous. With the "Novocain" injection there is adequate anæsthesia for about sixty minutes, while the use of "Percaine" (Ciba) gives about eighty minutes of satisfactory relaxation. This time should be ample for any gynæcological procedure.

In cases of difficult midwifery, especially in obstructed labour and eclampsia, the use of spinal anæsthesia is highly efficacious. There is apparently almost complete paralysis of the contraction element in the uterine action—such conditions as Baudl's ring subside entirely—while there is no interference with the retraction of the muscle fibres. By its use the number of mutilating obstetric operations may be materially reduced.

TREATMENT OF CRUSH FRACTURES OF THE SPINE.

By E. T. Cato.

[From the Alfred Hospital, Melbourne.]

Crush fractures of the spine are efficiently treated by the Watson Jones method[1] in which the patient is put up in a plaster cast after the deformity has been reduced in a position of hyperextension. The guiding principles in this treatment are as follows: If a fracture of the

Figure I. Showing method of reducing crush fracture of the spine.

spine is suspected the patient should be raised and transported in the prone position; this position helps to reduce the fracture. If possible, reduction of the fracture should be attempted within twenty-four hours of the injury.

One hour before actual reduction is attempted a hypodermic injection of 0·015 gramme (one-quarter of a grain) of morphine should be given to the patient. The patient should then have the thighs supported on a low fixed table and the arms and head rested on an operating table which is capable of being gradually raised (Figure I). In this picture the position is rather exaggerated. The hyperextension of the spine aided by gravity reduces the fracture.

As soon as the kyphotic deformity has disappeared, a plaster jacket is put on the patient while he is still supported by the two tables in

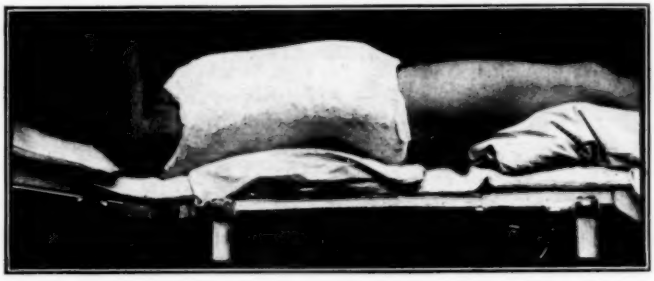


FIGURE II. Showing plaster after application (Case I).

FIGURE IIIA. Showing plaster, antero-posterior view.

FIGURE IIIB. Showing plaster, lateral view.

the hyperextended position. The plaster must extend well up the sternum and well down over the iliac crests. This is well shown on Figures II and IIIA and IIIB.

Two days after reduction and each day after that, the patient is frequently turned, and while in the prone position the lower limbs are extended against force and the head is lifted from the bed against resistance. These manipulations have for their object the exercising of the *erector spinæ* group of muscles. After three or four weeks the

FIGURE IV. Case I: Skiagram showing condition twenty-four hours later.

patient is allowed up, and is encouraged to walk a little. This treatment is well exemplified in the following two cases.

CASE I.—A.G., a woman, aged thirty-two years, was admitted to the Alfred Hospital on November 15, 1931, with a provisional diagnosis of fractured spine. An X ray examination made immediately on admission revealed a compression fracture of the body of the twelfth dorsal vertebra with marked kyphotic deformity.

The injury was due to a motor car accident in which the car turned over and the patient was thrown out with the car on top of her. Then she felt something snap in her back and had severe pain as she struck the ground. She was never unconscious; she was able to use her limbs, but the pain prevented her moving her body. Blood pressure, pulse and respiration were within normal limits when the patient was admitted to hospital. A few hours after admission

0·015 gramme (one-quarter of a grain) of morphine was given to the patient, and she was put up with hyperextension of the spine in plaster by the Watson Jones method.

Two days later an X ray examination was made through the plaster. The kyphotic deformity had been reduced, and the body of the crushed vertebra had almost regained its natural shape. Twice daily the patient was turned in the

FIGURE V. Case I: Skiagram showing condition some months later.

prone position, and the lower limbs were hyperextended in order to exercise the *erector spinæ* muscles. The patient was out of bed in four weeks, but she was left in the Watson Jones plaster for eight weeks, when a casein jacket was fitted; this was worn for five months. She now has full movement of the spinal column and can do everything.

CASE II.—T.T., a man, aged forty years, was admitted to the Alfred Hospital on December 4, 1931, with a provisional diagnosis of fracture of the dorsal part of the spine. The patient a few hours before admission fell with a veranda that collapsed under him, and he fell in a squatting position. He did not lose consciousness. He sat up with difficulty after the accident, but had severe pain in the back. He held on to a nearby fence and with the help of two men was able to walk to a van. X ray examination on admission revealed compression fracture of the lower dorsal area, apparently involving the twelfth dorsal vertebra. Kyphotic deformity was present. An injection of 0·015 gramme (one-quarter of a

grain) of morphine was given to the patient a few hours after admission, and the deformity was reduced by the Watson Jones method, after which a plaster jacket was applied reaching from the sternum to the pubes and embracing the iliac crests, and reaching well into the axillæ (Figure III).

An X ray examination was made two days after the plaster was applied, and the deformity appeared to be completely reduced. The patient was allowed

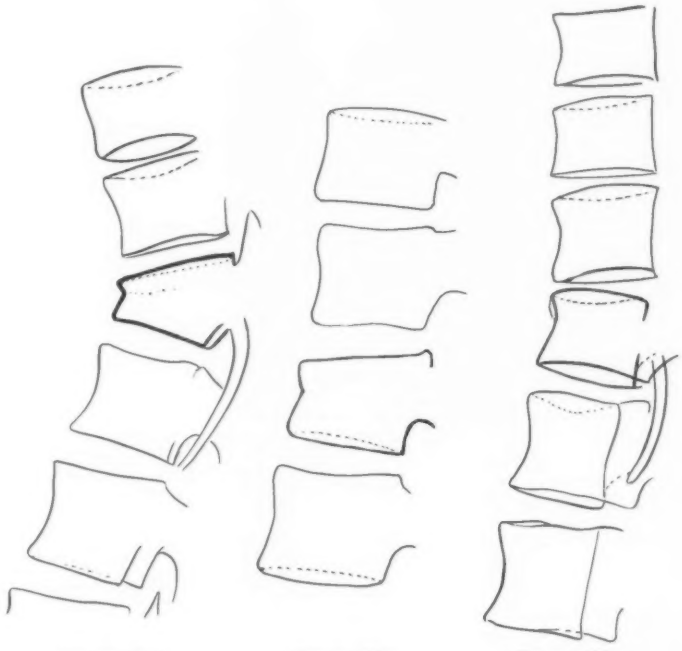


FIGURE VIA. FIGURE VIB. FIGURE VIC.

Figure VIA.—Case I: Diagram showing condition when the patient was admitted to hospital.

Figure VIB.—Showing condition twenty-four hours after reduction.

Figure VIC.—Showing condition some months after injury.

up after four weeks. The plaster was left on for three months, and then the patient was fitted for a metal and leather splint to support the spine.

An X ray examination one year later showed satisfactory union with quite an amount of callus formation. This patient is now doing full manual work.

If crush fractures of the spine are reduced early the results are invariably good.

It is very important to get these patients walking as soon as possible, because if they remain in bed too long, they are often psychologically unsound for the rest of their lives.

FIGURE VII. Case II: Skiagram showing condition before reduction of the fracture.

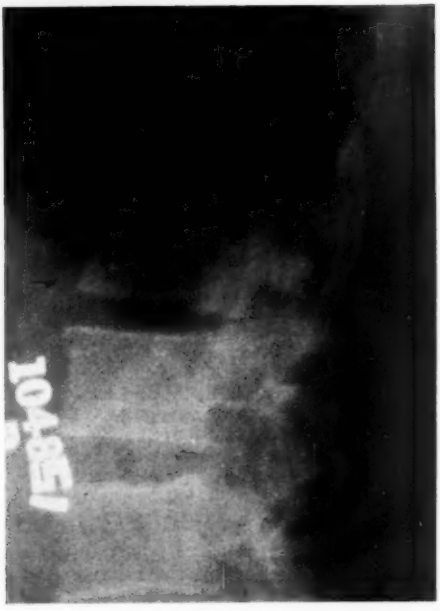


FIGURE VIII. Case II: Skiagram showing condition after reduction of the fracture.

CONCLUSIONS.

Further the so-called Kümmel's disease would not be heard of if all these patients were efficiently treated. Apparently Kümmel's disease is a condition resulting from undiagnosed crush fractures of the spine.

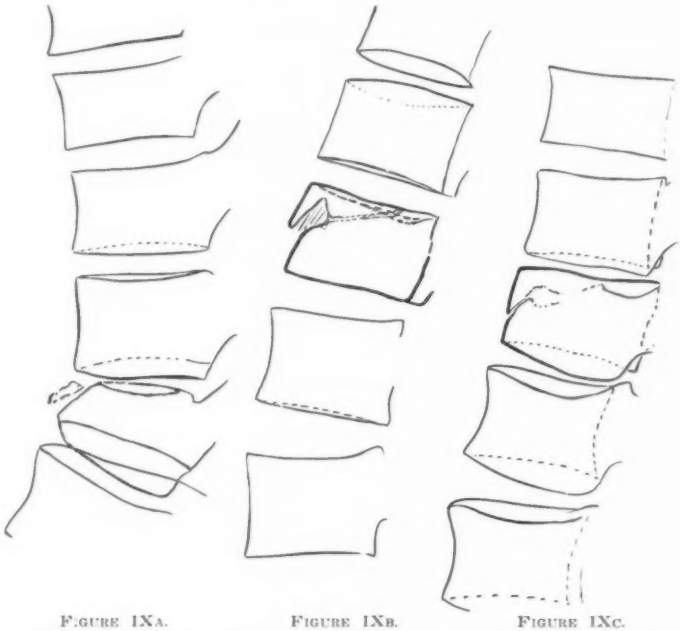


FIGURE IXA. FIGURE IXB. FIGURE IXC.

Figure IXA.—Case II: Diagram showing the condition before reduction of the fracture.
Figure IXB.—Showing condition twenty-four hours after reduction.
Figure IXC.—Showing condition some months after reduction.

REFERENCE.

(1) R. Watson Jones: "Manipulative Reduction of Crush Fractures of the Spine", *The British Medical Journal*, February 21, 1931, page 300.

THE TREATMENT OF CONCOMITANT SQUINT.[1]

By T. A'B. TRAVERS.

[From the Ophthalmic Department, Alfred Hospital, Melbourne.]

IN concomitant squint the aim of the surgeon is to produce not only a good cosmetic result, but a functional cure—to reestablish binocular vision. There are two main obstacles to this perfect end. They are: (i) amblyopia, (ii) abnormal retinal correspondence.

I do not propose to describe in detail the routine treatment of amblyopia, as it is familiar to you all. I would, however, mention one or two points that are of importance.

1. When a course of occlusion is undertaken, a determined attempt should be made by the parents to induce the child to use his amblyopic eye for as skilled vision as possible. Much more rapid improvement will be produced if the child uses his eyes for reading instead of simply for looking at large objects. Amblyopia is, of course, cerebral and not retinal in origin, and therefore mental concentration is all important in its removal.

2. A patient is never so old that one can say that occlusion of the fixing eye will produce no improvement in the amblyopic eye. It is not an uncommon occurrence for children of twelve years or more to improve the vision of the squinting eye rapidly as the result of a few weeks' occlusion.

3. Even when the amblyopic eye had been improved to, say, $^6/_9$ vision and the occluder has been removed, monocular exercises for the squinting eye, such as monocular reading, should be continued to prevent any recurrence of the amblyopia.

Abnormal correspondence is, in my opinion, the greatest difficulty that confronts the surgeon who wishes to obtain stereoscopic vision. It is, briefly, a condition in which an abnormal functional relationship exists between the two eyes. The macula of each eye, instead of functionally corresponding with the other macula, corresponds with some eccentric point. The condition is illustrated in Figures I and II.

Abnormal retinal correspondence is a very common condition; it occurred 35 times in a series of 131 cases of concomitant squint, which is 26·7%. It may or may not be associated with amblyopia. The causes of abnormal correspondence are not proven, but one fact is well established. The earlier in life a child squints, the more likely is he to have an abnormal retinal correspondence. A relatively poor result has been

[1] Read at the annual meeting of the Royal Australasian College of Surgeons, Sydney, April, 1933.

obtained in the majority of cases of abnormal correspondence that we have treated, even though a good cosmetic result has been attained.

The following cases illustrate some points of interest in the condition.

CASE I.—T.C., eleven years old, had squinted since he was eleven days old. The angle of squint was 30°, and an abnormal correspondence was present. After two operations the eyes were practically straight, the angle being 3°. Now, five months after the last operation, during which time the eyes have been practically straight, the abnormal correspondence has remained almost exactly as it was before treatment was commenced.

This case illustrates a type of anomaly that is very resistant to treatment and will, in all probability, never be cured. The next case is a slightly more hopeful one.

CASE II.—E.O., six years old, had squinted since she was three years old. The angle of squint was 60°, and abnormal correspondence was found. After

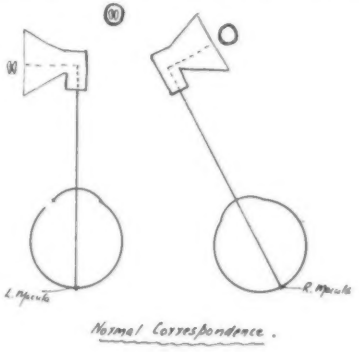


FIGURE I.

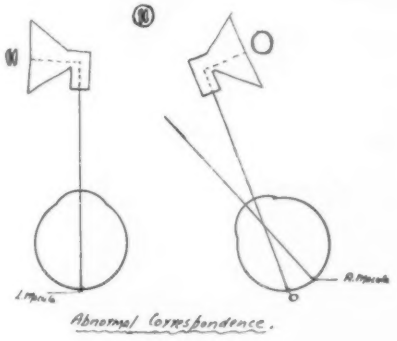


FIGURE II.

The patient is represented as looking into the synoptophore and in Figure I the butterfly is seen as in the net when the right and left maculæ are simultaneously stimulated by the net and butterfly respectively. In Figure II the butterfly appears to be inside the net when the left macula and the eccentric point O of the right eye are stimulated as shown. In Figure II, if the synoptophore is moved in such a way that the image of the net falls on the right macula, the butterfly will obviously appear to be outside the net.

orthoptic treatment had been continued without effect for fourteen lessons, an operation was performed. Since operation her eyes have remained straight and her retinal correspondence is gradually approaching the normal. Even now, seven months after operation, one macula does not accurately correspond with the other macula, but with a small area of about 5° surrounding it. Whether this "regional" correspondence will change to the normal "point" correspondence remains to be seen.

This case illustrates a less severe degree of abnormal correspondence with a less deeply ingrained anomaly. The patient is not yet cured, but there are reasonable grounds for hope.

The following two cases are cures.

CASE III.—M.R., aged four and a half years, had squinted for only six months. The angle was 60° and abnormal correspondence was diagnosed. After

two operations the eyes were straight and five and a half months later accurate stereoscopic vision and normal correspondence were attained.

CASE IV.—F.S., aged nine and a half years, had squinted for six months. The angle of squint was 45°, with abnormal correspondence. Operation was performed. Immediately after the dressings were removed the correspondence was abnormal, but four days later it had become normal, and in three months there was accurate stereoscopic vision.

In a table of abnormal correspondence cases to be shown later, we see that the average patient with this type of squint has squinted for 71% of his life. Now in Case I the patient had squinted for 100% of life, and no functional improvement had resulted from his operation. In Case II the patient had squinted for 50% of life and a partial improvement had occurred. In Cases III and IV the patients, who had been cured, had squinted for only 11% and 5% of their lives respectively. These cases suggest, therefore, that the longer the squint has existed, the less likely is normal correspondence to be established.

I am now going to describe the general outline of treatment of cases of concomitant squint as adopted at the Alfred Hospital, Melbourne.

When first seen the patient is usually very young and cannot give any active cooperation in his treatment. The first aim of the surgeon is to make sure that vision is good in each eye. Now, let us assume that this has been done, and the child (now perhaps about three years old) can fix with either eye as he pleases, that is, he has an alternating squint. The next step in the treatment is very important.

Try to ascertain if the retinal correspondence is normal or abnormal. This can sometimes be done quite easily, though at times it requires considerable patience. The child should be seated at the synoptophore, and will then usually look with some interest at the pictures he sees therein. Show him some simultaneous perception slides, such as the butterfly and the net, and demonstrate to him the way they move. If the child does not understand the difference between "inside" and "outside" the net, then show the parents what is required and tell them the information one wishes to obtain. All the child has to be able to say is whether the butterfly is in or out of the net, and, if outside, on the right or left of the net. I usually tell the parents to make drawings similar to the slides on transparent paper and to show these to the child at home. If these pictures are demonstrated to him at home, he will usually soon learn the differences in position of the butterfly.

Let us now suppose that the child has been so trained. We seat him at the synoptophore and set the instrument at his angle of squint. If the butterfly is now seen in the net, he has a normal retinal correspondence; if outside the net, abnormal correspondence.

Having ascertained this fact, I usually ask the parents to bring the child a week later and repeat the examination. This must be done until one is quite sure of the type of correspondence present, either normal or abnormal. The importance of this is that the prognosis and treatment of the case depend on the retinal correspondence.

If the correspondence is normal, one may tell the parents that a perfect functional cure may be reasonably expected, even though an operation may be necessary. If the child is very young, operative treatment may be delayed until he is old enough to have fusion training.

If the correspondence is abnormal, the outlook is much worse. A functional cure can only be hoped for, not anticipated with certainty. Operation should be undertaken at once in order to prevent the further conditioning of the abnormal process, and to place the eyes in a position favourable to the development of normal retinal correspondence.

Orthoptic Training.

Now let us consider the place of orthoptic training in the treatment of concomitant squint.

Firstly, I would ask you not to expect too much of fusion training. It is only a part of the adequate treatment of squint, and cannot be expected to work miracles. Orthoptic treatment aims at strengthening the fusion faculty, a cerebral function and not a retinal or ocular function. Now, a patient with an abnormal retinal correspondence is nearly always unsuitable for any orthoptic treatment, because the initial step to be taken before fusion can be established is to break down the abnormal correspondence and to reestablish normal correspondence. In the vast majority of cases in which we have attempted this, there has been no change in the correspondence, and all our efforts have been unavailing. Only in two cases have we broken down the abnormal correspondence. But, because the advantages of having fusion before operation are so great, it is always worth while trying to establish normal correspondence by orthoptic treatment. But if, after a few lessons, no change has been effected, it is, in my opinion, waste of time to persevere.

So we may summarize this briefly by saying that cases of abnormal correspondence do not respond to orthoptic treatment.

Now let us consider the orthoptic treatment of a case with normal correspondence. One has two opposing forces to consider: (i) an abnormal process striving to keep the eyes deviated, (ii) the fusion faculty striving to keep the eyes "straight". It depends upon which of these two is the stronger at any particular moment whether the eyes are turned or straight. Now, if the angle of squint is, say, 40°, it will obviously require a much stronger fusion to force the eyes straight than if the angle were 10°. Therefore, when the angle of squint is great, one cannot reasonably expect a cure from training alone, while if the angle is small or if the squint is periodic, a cure by training can be anticipated. Of course, there are many exceptions to this generalization, and one does see patients whose angle is quite large and who are cured after a course of orthoptic treatment, but they are rare. Again, one will see a patient whose angle is only 10°, and for whom a long period of training produces very little benefit.

Now, when should training be commenced? As soon as the child is old enough to cooperate. This largely depends on his alertness and

intelligence. Sometimes one may train a child of four years, but six to seven years is a much more satisfactory age. No person is too old to train, though, of course, the older a person is, the more difficult it is for him to spare the time. The oldest person we have trained is a woman of fifty-two years.

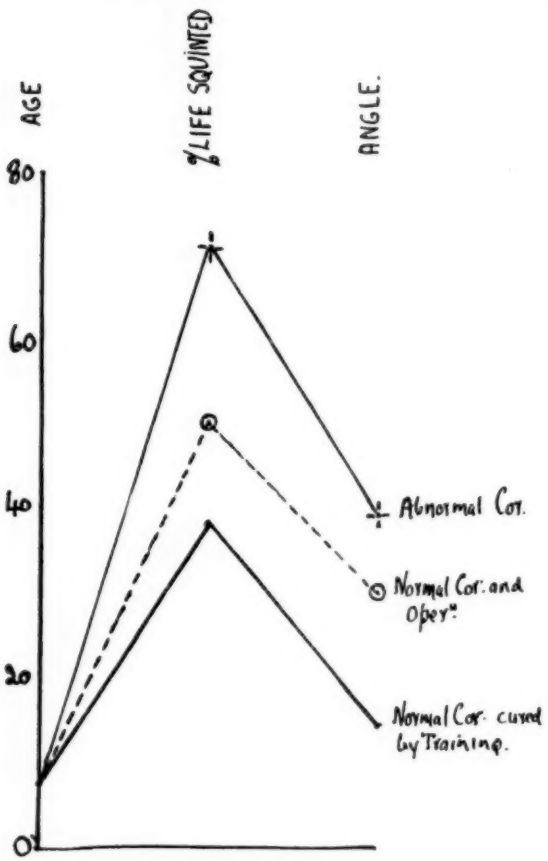


FIGURE III.

How good must vision be before training is commenced? Ideally, it should be $^6/_6$ in each eye, but the determining factor is probably the relative vision of the two eyes. If the better eye is $^6/_6$, the other should not be less than $^6/_{12}$; if the better is $^6/_9$, the worse not less than $^6/_{18}$. One is striving in the training to produce good fusion, which presupposes good vision in each eye. Orthoptic training is difficult and tedious enough without being hampered by defective vision.

How long should training be continued before operation is undertaken? I believe it should be continued until the child makes no further progress. This is ideal, but in most cases impracticable. After good fusion has been established, one may confidently expect a cure by operation and this can be explained to the parents. One says that continued training can do nothing but good and may eventually cure the squint altogether. Operation, however, will shorten the whole process, and probably give the cure at once. Many parents prefer operation to the weariness of long continued training, and this is particularly so when

the child is very sensitive to his deformity and is rendered unhappy by it. For this reason, I think it is very desirable to strive for a cure before the child goes to school.

One should also urge operation when a child either cannot or will not take any interest in his exercises. To continue training after good fusion has been attained in such a case is, in my opinion, waste of time and money.

CLINICAL RESULTS.

I shall now briefly describe the results obtained in a series of cases treated along the lines indicated.

First let me reiterate the frequency with which abnormal retinal correspondence is found. In a series of 131 cases it occurred 35 times (26·7%). This shows what a real problem it is. The following tables illustrate the results. I have only included in these tables those cases that I feel have reached a certain finality.

TABLE I.

Squinters with Normal Correspondence Cured by Training Alone.

Number of Cases.	Average Age.	Part of Life Squinted.	Angle.
24	7·1 years	38%	14°

Amongst the cases set out in Table I the greatest angle of squint was 35°. Among the 24 patients, there were eight with periodic squint.

TABLE II.

Squinters with Normal Correspondence Treated by Training and Operation.

Number of Cases.	Average Age.	Part of Life Squinted.	Angle.
12	7·3 years	50%	30°

The results in the cases shown in Table II are eight cures and four in which improvement resulted. Of the patients whose condition improved, one developed stereoscopic vision since operation, two had stereoscopic vision before operation, one has not developed stereoscopic vision since operation.

TABLE III.

Squinters with Abnormal Correspondence Treated by Operation.

Number of Cases.	Average Age.	Part of Life Squinted.	Angle.
14	7 years	71%	39°

Of the results shown in Table III, in nine cases the eyes were straight; in four cases the eyes were straight and have since converged: in one case the squint was over-corrected and the eyes have remained divergent.

Of the nine patients whose eyes are straight, two represent cures, one has normal correspondence, five have improved correspondence, one has unchanged correspondence.

Figure III shows graphically the three groups that have been described in the tables.

While all the patients are about the same age, the period of life during which the patient has squinted and the angle of squint are very different.

These tables indicate clearly the better prognosis of those patients who have normal correspondence.

OPERATION.

When planning an operation one must bear in mind the patient's binocular functional state. If a patient has, say, 10° of fusion, an operation which will place the eyes within 10° of straight will give a perfect result, as natural fusion will bridge the technical defect. If a patient has only 1° of fusion, the surgeon must be accurate to within 1° to produce a cure.

In a case of abnormal correspondence, the surgeon is not only called upon to exercise great operative judgement, but has to contend with a force of unknown strength which is probably striving to deviate the eyes. You will remember that in Table III, in four of the cases, although the eyes were almost straight after operation, convergence has since recurred. In these cases you are working against nature, while in a case of normal correspondence nature is aiding your efforts. This, I think, is the ultimate cause of the relatively bad results.

FUNCTIONS OF AN ORTHOPTIC CLINIC.

Now let us briefly consider the functions of an orthoptic clinic. They are two: (i) diagnostic, (ii) therapeutic.

(i) *Diagnostic.* Without some machine, such as the synoptophore, abnormal retinal correspondence cannot be diagnosed with certainty. Upon the diagnosis of this condition depends the prognosis and the procedure of treatment to be adopted.

(ii) *Therapeutic.* In some cases, as has been shown, a cure can be definitely effected by fusion training alone. Others can be made ready for operation by a short course of training. By this means the natural process of fusion is wakened, and when the eyes are placed almost parallel by the surgeon (as that is all that most of us can hope to do), nature will effect a cure. There is no functional benefit to be obtained by operation on a child's eyes when an alternating suppression is so far advanced that no binocular vision can be attained.

Sir John Parsons, in his book on "Diseases of the Eye", says that orthoptic treatment, although very tedious, has "one overwhelming argument in its favour—when successful, it cures the squint".

By following the procedure suggested in this brief address, I believe that much of the waiting and uncertainty in the treatment of concomitant squint can be avoided and a large number of actual cures confidently expected.

Surgical Technique.

CHOLEDOCHOLITHOTOMY WITH INTRADUODENAL DRAINAGE AND CLOSURE OF THE COMMON DUCT: MacCORMICK'S TECHNIQUE.

By Douglas Miller,
Sydney.

The following is an account of the technique, and results of the operation of choledocholithotomy followed by immediate closure of the common duct, as originally evolved, and practised for many years, by Sir Alexander MacCormick.

Perusal of the records of the Royal Prince Alfred Hospital shows that this technique was first employed by MacCormick in 1909. The operation was being performed on a jaundiced patient with a long history of epigastric pain and biliary colic. A large calculus impacted in the lower end of the duct could not be displaced upwards by the usual manipulations. The duodenum was thereupon opened and the stone cut down upon and removed piecemeal. Hegar's dilators were then passed down from the opening in the common duct into the duodenum until the orifice had been considerably dilated. The duodenum and duct were then carefully sutured and a drain tube was passed down to the region of the duct. It was interesting to note that a small chronically inflamed gall bladder was then opened and drained. This appears to be not only the first occasion on which MacCormick practised primary closure of the duct, but one of the last on which he performed cholecystostomy as the routine operation for gall stones. At this time the practice of routine cholecystectomy appears to be in advance of contemporary surgical thought.

We find that subsequent to this period the operation of choledochotomy was always terminated by dilatation of the ampulla of Vater, and suture of the duct without drainage. The technical details of the operation as practised then are identical with those which MacCormick and those who follow his methods use at the present time.

Exposure.

A medium sized sandbag is placed beneath the patient's back at the level of the angle of the scapula.

Though the right paramedian incision may be used, the one employed particularly in subjects with a wide costal angle, extends from below the tip of the seventh costal cartilage, downwards and outwards towards the anterior superior iliac spine. The anterior sheath of the rectus is divided in the line of the incision, and the muscle is partly split and partly divided between ligatures in the same line. The superior epigastric vessels are included in that part of the muscle which is divided between ligatures. The posterior sheath of the rectus is then incised. If this incision is not carried downwards below the level of the umbilicus, it results in no appreciable weakening of the abdominal wall. If further exposure is desired it may best be obtained by extending the incision upwards into the epigastric angle rather than downwards.

Hand retraction is used, an ample sponge being packed into the abdomen above the pyloric end of the stomach and duodenum. The left hand of the assistant is placed on this and sweeps the sponge and underlying viscera downwards, at the same time tending to lift them forwards towards the anterior abdominal wall. If necessary, the transverse colon may be kept out of the field by means of another

small sponge packed into the right corner of the wound. The gall bladder and ducts are now carefully examined. Cholecystectomy forms the first stage of the operation. In this operation an initial effort is directed towards placing a ligature around the cystic duct, the entrance into the common duct thus being closed against small calculi or infective material which may be squeezed into it during

FIGURE I. Showing method of hand retraction. The gall bladder has been removed.

manipulations of the gall bladder. A ligature should then be passed around the cystic artery. Needless to say, these structures should be displayed beyond all shadow of doubt before any ligature is tied. When the anatomy in the region of the neck of the gall bladder is obscure, the dissection is commenced at the fundus, but even in this event a provisional ligature should be passed around what appears to be the cystic duct. This should not be tied until verified, but may be held taut, which will prevent the passage of contents.

Indications for Exploration of the Common Bile Duct.

The indications for opening the common duct are, firstly jaundice, or a history of jaundice associated with cholelithiasis. It is important to bear in mind that even a somewhat remote history of jaundice may be the only indication to a "ball valve" calculus which has never passed out of the common duct.

The next indication is palpable calculi in the duct, and in this regard it is important to remember that calculi in the lower end of the duct are often not palpable, and others may easily slip upwards out of the grip of the fingers.

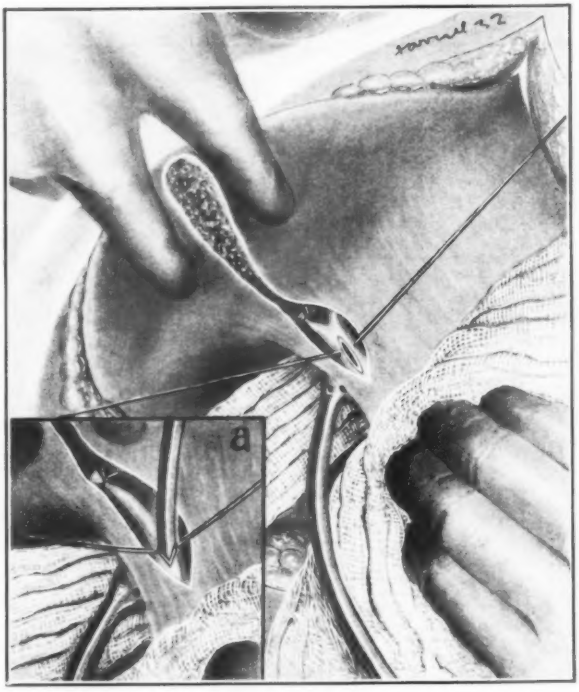


FIGURE II. Opening the duct. Note position of sucker and guy sutures. Inset: Sounds being passed into the duct.

An obviously dilated common duct invites exploration, and a wide cystic duct associated with a gall bladder full of small calculi is a combination specially suited to allow the passage of stones into the common duct.

Preparation of the Field.

Before the common duct is opened, it is important to prepare for the escape of the contents, which may be infective, or impregnated with fine gritty material. Two sponges are spread over the edges of the wound and those under the assistant's hand are readjusted. Roll gauze is packed down into the epiploic foramen, and a suction nozzle is placed at the side of the duct. The peritoneum of the gastro-hepatic omentum is split, and two guy sutures of fine silk are passed through each side of the duct at the most convenient point. With the aid of

these sutures the duct is steadied and lifted slightly forward into the wound. A small vertical cut is now made with a scalpel between these sutures. Occasionally one has to take pains to avoid a small blood vessel on the wall of the duct close to the duodenum, which is liable to cause troublesome bleeding. The initial rush of bile and *débris* is sucked away, and a small malleable scoop is passed down the duct, and any calculi are removed. Occasionally a hand may have to be introduced into the wound in order to manœuvre an unwilling stone into the embrace of the scoop or Desjardin forceps.

After clearing the duct of obvious calculi, an attempt is made to pass a proble through the ampulla into the duodenum. If this passes, it is followed by a

FIGURE III. Closure of the duct and the gastro-hepatic omentum.

small urethral sound or Hegar's dilator, and increasing sizes of these are passed until the orifice of the duct is dilated to about the size 11/13 Lister, or more. A characteristic sense of resistance followed by a slight forward jump of the sound is experienced as each instrument slips through the ampulla. It is no uncommon experience in this manœuvre to find that a small sound will pass without difficulty, but a larger one following it will be greeted by a resistant barrier. This new obstruction is always a calculus, and fresh efforts must be directed towards its removal. It may then occur that another few sounds will pass and again an obstruction will be encountered. This will be another calculus. In this way it occasionally happens that the passage of sounds appears to call up relays of calculi from some undivined recesses in the lower end of the duct. Such experiences are a good demonstration of the inadequacy of scooping alone

in completely clearing the duct. Before completing the operation, a scoop or sound is passed upwards into the hepatic ducts.

Obviously all these manipulations are to be carried out with the utmost gentleness, the most tantalizing conditions never justifying force. Occasionally it may be impossible to dislodge a stone from the lower end of the duct, and in this contingency the second part of the duodenum should be opened. A sound passed downwards to the obstruction pushes the impacted calculus forwards, making an obvious prominence on the internal aspect of the duodenum. This is cut down upon and the calculus extrudes. Sounds are now passed, hæmostasis is secured and the duodenum is closed. It is probably wiser to embark early on this manœuvre than to waste time and inflict damage in prolonged attempts to dislodge an impacted calculus upwards.

Closure of the Duct.

A fine catgut running suture now closes the duct. Another fine suture reunites the cut gastro-hepatic omentum. It is continued upwards over the gall bladder bed.

Drainage.

A large drainage tube with a small central gauze wick is introduced through a stab wound in the loin, and adjusted with its inner end lying close to the right side of the duct. This wick will serve to anchor the end of the tube. It is not advisable to place it against the line of suture in the duct, which its removal may disturb.

Subsequent Course.

It is a common experience to find that nothing escapes from the tube, which should then be removed at the end of two or three days. In other cases, however, a small quantity of bile may escape, but invariably ceases in a few days. In this event the tube is removed on the cessation of drainage.

Appended is a tabulated summary of twenty consecutive cases treated in this way at Saint Vincent's Hospital, Sydney.

ANALYSIS OF TWENTY CONSECUTIVE CASES OF CHOLEDOCHOTOMY WITH PRIMARY CLOSURE OF THE COMMON BILE DUCT.

Case Number.	Indication for Opening Duct.	Operation.	Removal of Tube.	Discharged after Operation.
1	Jaundice.	Removal stone and dilatation.	4 days	24 days
2	History jaundice.	Dilatation.	6 ,,	39 ,,
3	Jaundice.	Removal stone and dilatation.	4 ,,	22 ,,
4	History jaundice.	Removal stone and dilatation.	3 ,,	28 ,,
5	Jaundice.	Removal and dilatation.	4 ,,	20 ,,
6	Jaundice.	Removal and dilatation.	3 ,,	26 ,,
7	History jaundice.	Dilatation.	3 ,,	22 ,,
8	History jaundice.	Dilatation.	3 ,,	40 ,,
9	History jaundice.	Removal and dilatation.	3 ,,	38 ,,
10	History jaundice.	Dilatation.	3 ,,	20 ,,
11	History jaundice.	Removal and dilatation.	2 ,,	19 ,,
12	Jaundice.	Removal and dilatation.	3 ,,	17 ,,
13	History jaundice.	Dilatation.	2 ,,	22 ,,
14	Jaundice.	Removal and dilatation.	2 ,,	19 ,,
15	History jaundice.	Dilatation.	6 ,,	22 ,,
16	History jaundice.	Removal and dilatation.	2 ,,	24 ,,
17	History jaundice.	Dilatation.	5 ,,	23 ,,
18	Jaundice.	Removal and dilatation.	3 ,,	24 ,,
19	Jaundice.	Removal and dilatation.	3 ,,	20 ,,
20	Jaundice.	Removal and dilatation.	3 ,,	22 ,,

Acknowledgement.

I have to thank Sir Alexander MacCormick for reading and making suggestions in, the presentation of this description of his method.

A SADDLE APPLIANCE FOR BEARING THE BODY WEIGHT.

By HUGH C. TRUMBLE,
Melbourne.

FROM time to time various forms of apparatus have been utilized by surgeons to relieve a lower limb of the strain of weight-bearing. Probably the most widely used at the present time is the caliper splint, a modified form of the Thomas knee appliance for use in walking. Thomas, in his book entitled "Diseases of the Hip, Knee and Ankle Joints", published in the year 1878, discussed and illustrated other forms of apparatus, the chief of which are reproduced in Figure I. In Figure II is depicted Thomas's knee appliance for walking.

It will be seen that in most of these splints the weight of the body is transmitted to the apparatus through the medium of a padded metal band or ring, which is rigidly fixed to

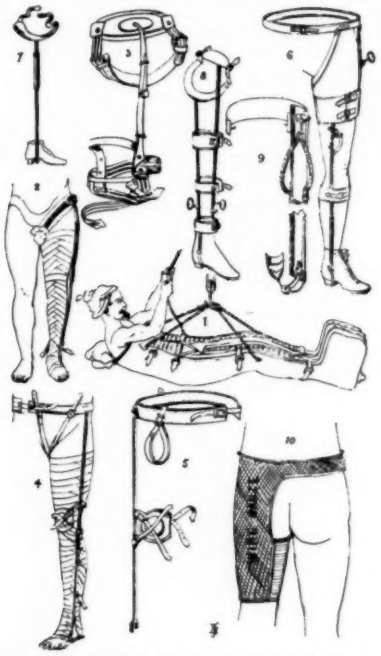


FIGURE I. Plate taken from Thomas's book. 1 = Bonnet's grand appareil; 2 = Davis's hip appliance; 3 = Sayre's hip appliance; 4 = Taylor's hip appliance; 5 = Washburn's hip appliance; 6 = Hutchinson's (of Brooklyn) hip splint; 7 = Dr. Andrew's (of Chicago) ischiatic crutch; 8 = Bauer's hip appliance; 9 = Hamilton's hip splint.

FIGURE II. Thomas's knee appliance for walking. Caliper splints are modifications of this apparatus.

the uprights of the apparatus. In Andrew's ischiatic crutch there is only one upright passing from the crutch to the ground. It is situated on the inner side of the leg. In some of the others a single upright is situated on the outer side of the limb.

In using the various forms of apparatus the patient is supposed to sit, as it were, on the perineal band when his sound limb leaves the ground, and so to obtain support from the splint. Thus supported, he is able to take a step without weighting the diseased member. In practice it is difficult to keep the perineal band in contact with the tuberosity of the ischium, more especially in fat people, and each movement of the limb at the hip joint results in movement of the ring or band in relation to the pelvis. The ring tends to slip so as to bear mainly on the skin over the ischial ramus, which is not well fitted to withstand pressure. Consequently, a caliper splint which is fitted so as really to support the weight of the body in walking is usually most uncomfortable.

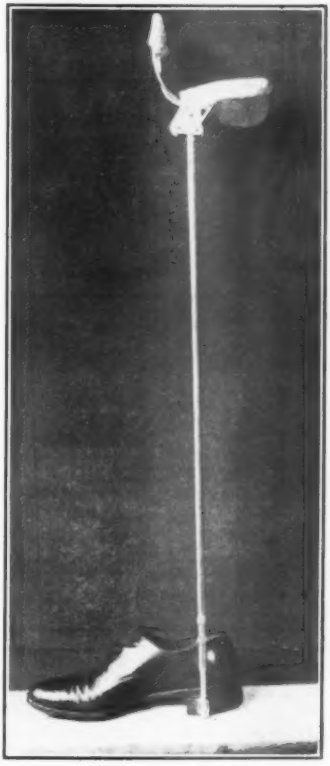


FIGURE III. The author's appliance.

In designing the splint to be described, attention has been paid to the following points:

1. The patient, though erect, is to sit on the support whilst making a step with his sound limb. Therefore he may as well utilize both tuberosities, as he does in the normal sitting posture.

2. Movement at the hip joint of the affected limb will result in undesirable movement of the seating surface of the splint relative to the pelvis, unless provision is made to allow of it moving with the pelvis. Thus it must be hinged on the upright member of the support.

3. The weight of the body should be transmitted from the seat to the ground by a rigid member placed as nearly as possible under the centre of gravity of the body, that is, in the mid-sagittal plane. In this connexion it may be noted that the lateral member of a caliper splint probably transmits very little of the weight of the body to the ground.

Description of the Appliance.

The upper member of the appliance consists of a framework of steel wire bent as shown in Figure V, A, C and D. Over the posterior saddle-shaped portion of this is stretched a sheet of thin aluminium (Figure V, C). The anterior extension curves forwards between the legs, skirting the perineum, and reaching almost to the level of the pubic crest. To the transverse bar at its upper end an oval plate of aluminium is attached in such a way as to permit of limited movement. The wires, in passing from the perineum to the pubis, diverge so as to leave an opening through which the penis and scrotum are passed. The saddle and pubic plates are covered with spongy rubber bound on with smooth leather (Figure IV). The saddle bears on the skin over the ischial tuberosities, and provides a strong, comfortable weight-bearing surface. The pubic pad adapts itself to the skin

surface in the region of the pubic crest, and serves to steady the apparatus and prevent it from becoming displaced. A steel plate cut to the shape shown in Figure V, B, is bent in the form of an inverted U and welded strongly to the under surface of the frame at its narrowest point (Figure V, C and D). Three strong pins pass transversely through the limbs of the U plate (Figures IV and V, C and D). The uppermost of these pins passes through a hole in the upper extremity of the upright member of the apparatus. Thus the saddle member can move on the latter in the sagittal plane. Movement is limited by the remaining two pins. The upright member is of strong tubular steel, provided at its upper end with a solid fitting through a hole in which the uppermost pin passes. This fitting is brazed or welded into the upper extremity of the tube. At the lower end of the tubular member is another solid steel fitting (Figure V, E and F) which slips into the tube and permits of adjustment in length of the apparatus. Through the lower end of this fitting a hole is bored for the reception of a strong pin which is firmly screwed into the heel of the boot. The pin is shaped as shown in Figure V, F, and is provided with a washer and split pin. A spacing block of soft steel is placed between the heel of the boot and the lower end of the upright member, and is cut flush with the heel so that it transmits weight from the heel pin to the ground (Figure V, E and F).

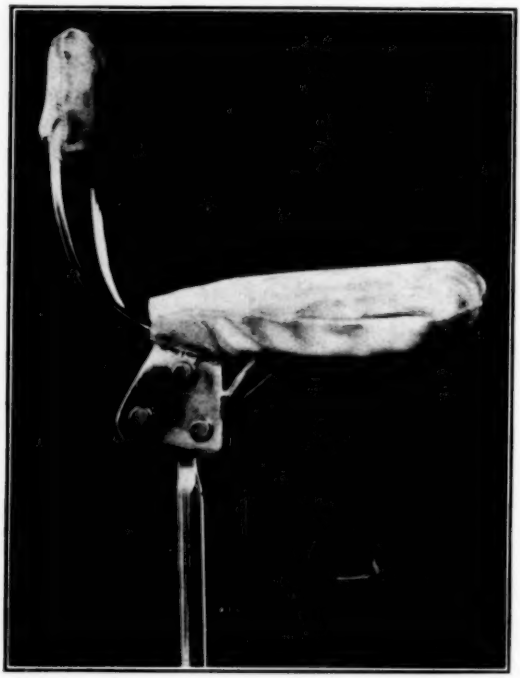


FIGURE IV. Saddle member of the author's appliance. For description see text.

The Use of the Apparatus.

In the case of a male patient the appliance is worn beneath the trousers, but outside the underpants. The trousers removed, the patient slips his foot into the shoe and laces it up. Then, whilst he sits with the affected leg fully extended, the sound limb is flexed and abducted at the hip to such an extent that the saddle may be slipped under the perineum. The penis and scrotum are passed through the opening of the underpants and the opening in the appliance below the pubic pad. Trousers are then slipped on and the patient is ready to walk. If trousers of a "baggy" type or "Oxford bags" are worn, the shoe with the attached splint may be slipped through from above without removing the garment. To remove the saddle from the perineum in order to defæcate, and in the case of females to micturate, it is only necessary for the patient to sit down, abduct and flex the sound limb, and

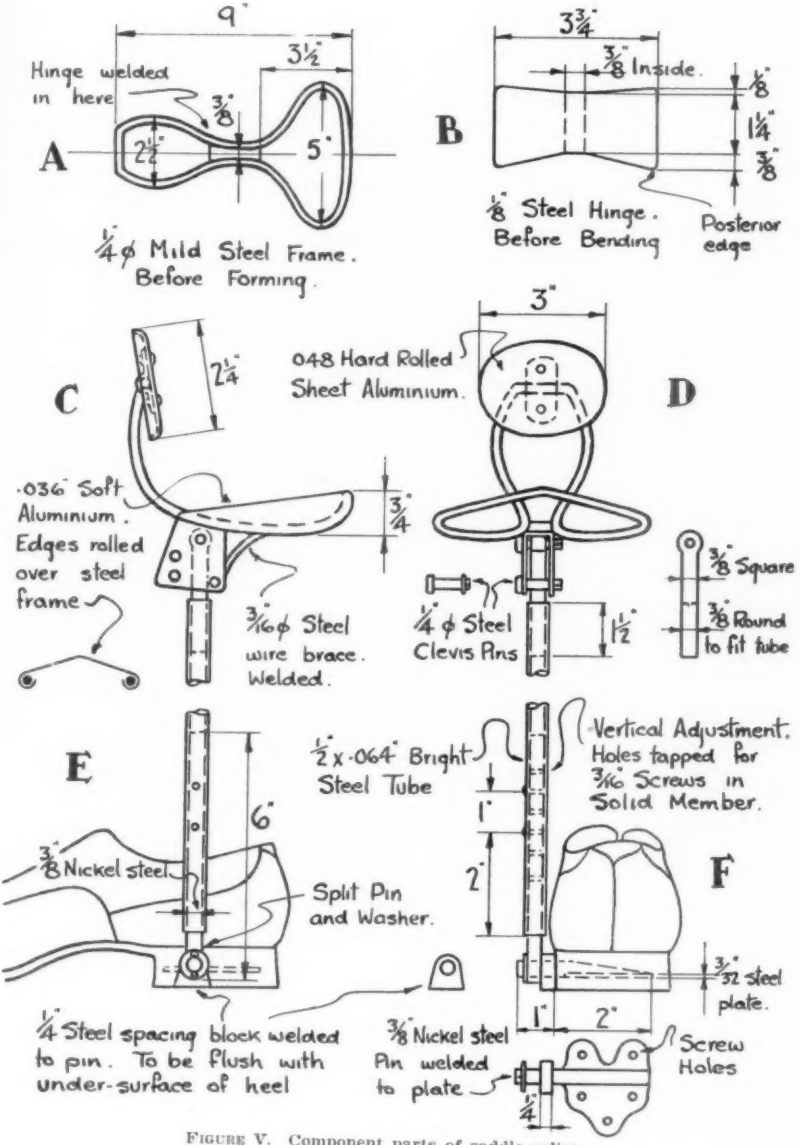


FIGURE V. Component parts of saddle splint.

F

slip out the saddle towards the sound side and then forwards. The shoe need not be unlaced.

With the limbs together the saddle cannot become displaced, as the pubic pad prevents backward movement, and the wide saddle cannot pass forwards between the thighs. There is no tendency for the tuberosities of the ischial bones to slip off the saddle. Micturition in the male does not entail interference with the splint. At first the patient may use a crutch or stick to steady himself in walking, but after a time no such support is necessary as a rule.

The reader will note that there is no band encircling the limb. If for any reason such should be desirable, it is a simple matter to attach fittings of suitable shape to the upright member at any point. When it is necessary to stiffen the limb, as for instance in the case of an ununited fracture of the femur in its lower third, the author applies a light moulded leather or beaten metal splint. This is far more effective than bands attached to the apparatus, the latter being reserved for the one purpose of relieving the limb of weight.

As both tuberosities rest on the saddle, the skin is subjected to only about one-half of the pressure that a support such as a caliper splint would occasion. Further, there is no possibility of pressure falling on the skin over the pubic rami or perineum. Hence a properly adjusted saddle appliance is comparatively comfortable to wear.

Adjustment of the Apparatus.

The design of the splint is such that, on standing, the centre of gravity of the body lies in a coronal plane behind that passing through the pin on which the saddle is hinged. Thus the weight of the body bearing on the posterior part of the saddle causes the latter to fall. It is prevented from passing the horizontal by a second pin. If it is desired to stop the movement short of the horizontal, a ferrule of the requisite thickness is slipped over the pin, between the plates through which it passes. Adjustment in the opposite direction is made by bending the upright member slightly at its upper solid end. The pubic pad should not press heavily on the patient. If it does so, it is probably because the ischial saddle has not been allowed to fall low enough. The pubic pad is attached to the transverse bar at the upper extremity of the wire frame of the saddle by means of a swivel joint. It thus accommodates itself to the plane of the skin surface. The transverse bar should lie a little below the upper margin of the pubic crest, so that the pubic pad bears partly on the pubic bone and partly on the abdominal wall above the crest. The pubic pad may be adjusted in relation to the saddle by bending the wire framework in the region of the former. If the distance between the pad and the saddle be too great, the frame between may press on the perineum. When the patient swings the affected limb forwards in walking, movement takes place at the hinge joint, and may be limited by a third pin placed in front of the upright member. The pin is usually placed so as to permit of an angular movement which corresponds to that through which the limb moves in making a step of about eighteen inches. It may, however, be placed so as to abolish movement at the hinge. As the apparatus obtains a firm grip on the pelvis at three points, such a procedure will very greatly restrict movement at the hip joint. This may occasionally be desirable.

As regards length, the splint is, of course, made as nearly as possible correctly, but a fine adjustment is provided at the lower end. Two screws pass through holes in the tube into the solid lower fitting. In this there are five tapped holes situated at intervals of half an inch, so that ample adjustment is provided to compensate for a small error in manufacture. The length is adjusted so that when the patient is erect in the saddle, his heel is just clear of the inner surface of the heel of his boot. It is well to raise the heel of the shoe on the sound limb slightly in order that the splinted limb may clear the ground easily in walking.

Indications for the Use of the Apparatus.

Briefly, the splint may be used whenever it is desired to relieve a limb of the strain of weight-bearing, whilst permitting the patient to walk. It is unnecessary to enumerate the various conditions which call for such treatment.

Details of Manufacture.

Naturally the measurements vary to suit different patients, though not nearly so much as in the case of caliper splints. Thus it is frequently possible to adapt an appliance made for one patient to the use of another without much in the way of alterations. Further, a splint originally made for a right limb may be used again on a left limb.

Instructions for the making of an appliance suitable for an adult man of medium size and weight will be given, and no very great variation will be necessary in this category. For very heavy patients slightly heavier, for children lighter, materials may be used. Such details may be left to the reader in consultation with his splint maker. In assessing the dimensions of a saddle in any particular case, a fair idea may be obtained by bending a piece of malleable wire as nearly as possible to the required shape.

A length of quarter-inch round mild steel rod is bent to the shape shown in Figure V, A, and its ends are welded together. A steel plate shaped as shown (Figure V, B) is bent (Figure V, D) and welded to the frame somewhat behind its central point (Figure V, A). The frame is then bent to the final shape (Figure V, C and D). Holes are drilled for the clevis pin (quarter-inch). The aluminium saddle is worked on, its margins being rolled over the wire of the framework. An elliptical aluminium pubic plate (three inches by two and a quarter inches) is then attached to the upper transverse bar of the frame in such a way as to permit of limited movement. The saddle may be strengthened by welding short lengths of metal rod in the angles between the pin-bearing plate and the frame posteriorly on each side. The pins are engineer's clevis pins. The upper solid fitting of the upright member is forged from a nickel steel rod (three-eighths of an inch square) and is brazed into the tube. The lower fitting is also of nickel steel, forged to the shape shown in Figure V, E and F.

To the heel pin is welded a plate which is screwed or riveted to the heel and then covered over with leather. A mild steel spacing block brazed to the heel pin serves to keep the upright at the correct distance from the boot and to transmit weight from the heel pin to the ground in a line almost directly under the upright member of the appliance. This helps to prevent the heel pin from working loose from the leather heel. The whole of the steel components of the apparatus should be chromium plated. The pubic plate and the saddle surface are covered with spongy rubber bound on with soft leather (Figure IV).

Variations of Design.

The appliance may be varied to suit particular cases. Thus a knee joint with a locking device may be fitted. Bands or straps may be attached to the upright at any point. As a rule, however, the simple design described above is all that is required.

It would seem to be quite feasible to fit two uprights, one for each leg, to the same saddle. The author has not as yet had occasion to employ such an appliance, but occasionally one might be called for.

Possibly the saddle part of the apparatus could be used in the construction of artificial limbs. So far this has not been attempted.

The author would be very pleased to hear from any reader who may in the future hit upon useful variations or improvements in design of the apparatus.

Acknowledgement.

The author wishes to acknowledge his indebtedness to H. K. Lewis & Company, Limited, publishers, for permission to use Figures I and II.

SUTURAL HÆMOSTASIS IN SUPRAPUBIC PROSTATECTOMY.

By R. J. Silverton,

Honorary Urologist, Coast Hospital; Honorary Urologist, Royal North Shore Hospital of Sydney.

For quite a number of years the efforts of many urologists have been directed towards removing the one great technical fault of prostatectomy—inefficient hæmostasis. It was realized that a sutural method would be the ideal one, but the mechanical difficulties seemed insuperable.

Thomson Walker and Judd were pioneers in these efforts, but their results, though of great value, were incomplete as regards practical hæmostasis. Thomson Walker, however, contributed in a most valuable manner to the development of this work by devising means for efficient retraction of the bladder and visualization of the prostatic cavity. Internal illumination of the bladder cavity has been used by many people, and is an essential in this difficult work.

But perhaps the greatest instrumental achievement of all was made by Hugh Young, of Baltimore, in his invention of the "boomerang" needle-holder and needle, together with his suture-carrier which takes the suture easily down to the needle-slot. These instruments, slightly modified, have made possible the splendid work achieved by Harry Harris in sutural hæmostasis in the bleeding prostatic cavity.

Only a few weeks before Harris published his original report,[1] W. E. Lower, in the United States, described a method of sutural hæmostasis in which an ordinary needle was used, and which, except by the exercise of almost unbelievable surgical dexterity, seemed impossible of practical attainment; moreover, there was distinct risk of after-stricture at the bladder neck. Lower's closure of the anterior portion of the cavity by transverse approximating sutures somewhat resembled Harris's, however.[2]

Practical surgical possibility was realized in Harris's work, chiefly because he made use of the remarkable boomerang needle-holder of Young. This had been used by most urologists for deep bladder work for many years before, but never for suturing the trigone down to the floor of the prostatic cavity. The latter contribution, which was an entirely original thought on Harris's part, is of immense value, for it not only helps in hæmostasis and restores the anatomical insertion of the trigone into the floor of the prostatic urethra, but it gets rid of the trigonal "ledge", the origin of bilocular formation and of obstruction, by flattening it down in a safe and sure manner. The treatment advocated by Thomson Walker was to cut a wedge out of this ledge, but there is no doubt the Harris method is superior.

Some have doubted the possibility of this suture holding long enough to enable the trigone to adhere permanently. I may state that I have not yet had a case of obstruction or fistula following my use of Harris's technique. Further, I have not infrequently examined patients by the cysto-urethroscope within a few weeks of the operation, as well as later, and have always observed a smoothly flowing surface between the floor of the prostatic cavity and the trigone of the bladder.

The essential thing is for the needle to take a sure and strong bite of the floor of the prostatic cavity, and this is really the most difficult part of the operation. For this reason I commenced, about the end of 1930, attempts to aid

insertion of the needle into the floor of the prostatic cavity by means of elevation of the latter through the rectum, instead of traction by forceps as advocated by Harris. The result of many experiments in curves and lengths was the slightly less than right-angled instrument illustrated in Figure I. This prostatic cavity elevator is very conveniently shaped for easy insertion and holding by an assistant, but is awkward for carrying in a bag, so I have had it made in two pieces, as shown in Figure II.

FIGURE I. The prostatic cavity elevator assembled.

After enucleation of the prostate by the method of intraurethral adenomectomy, which leaves the anterior commissure untouched, and which preserves as much as possible of the mucosa of the floor of the prostatic urethra, Thomson Walker's automatic bladder retractor is introduced. I have had special lateral blades made for this instrument, two-thirds the width of the usual blades, for use in two-stage prostatectomy, the technique of which is described later (Figure III). To the posterior blade I have had adapted a special light carrier (Figure IV). The lamp is an eight volt lamp, and shines forward directly into the prostatic cavity without shining into the eye of the operator; illumination is excellent.

After trimming the edges of the cavity, and compressing its depths for a minute or so with a gauze tampon, the surgeon inserts the posterior or trigonal suture. The assistant covers with vaseline the end of the prostatic cavity elevator, and slides it backward along the perineum till it slips into the rectum. The spatulate end elevates an easily felt, and usually visible, ridge in any portion of the floor of the cavity the operator desires.

Young's boomerang needle-holder, armed with Harris's largest needle, is now taken, and the point of the needle is inserted, as recently advised by Harris, into the floor of the bladder just behind the interureteric bar (S. H. Harris, verbal communication). The needle is pushed forward, without depression of the piston of the needle-holder, until its point just engages the elevated ridge. The piston is now depressed by the palm. This makes the needle curve forward, and so all risk of injury to the rectum is avoided. Next, the needle travels backward into the bladder cavity, skirting the anterior edge of the prostatic cavity as it does so. In the bladder cavity the needle receives the number 3 plain catgut suture carried down to it by a Young suture-carrier (Figure V). After the needle has been allowed to retrace its path and is

FIGURE II. The prostatic cavity elevator taken apart for convenience in carrying.

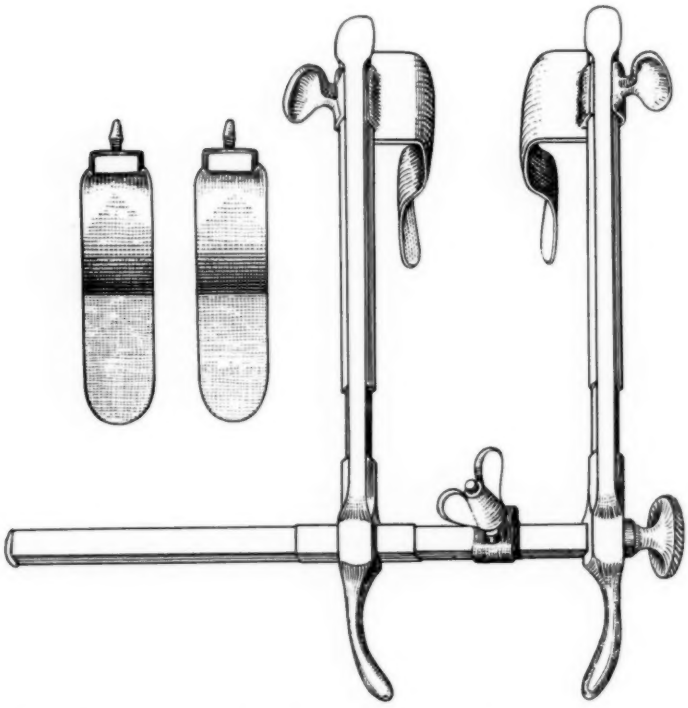


FIGURE III. Thomson Walker's bladder retractor with lateral blades only in position. To one side are seen, face on, a pair of narrower lateral blades for second stage operations.

disengaged from the suture, the latter is tied. Care is taken to slide the knot well down into the prostatic cavity, the elevator meanwhile being removed from the rectum.

I consider that depression of the trigonal ledge and help in the hæmostasis are more important results of this suture than the plastic effect of reformation of the floor of the urethra, though this is, in part at least, achieved.

The next step is the placing of the postero-lateral hæmostatic sutures. Harris inserts simple sutures at about the four and eight o'clock positions. I prefer to

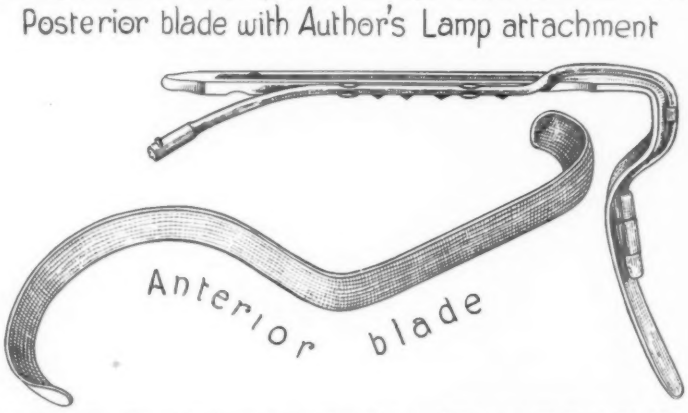


FIGURE IV. The posterior and anterior blades of Thomson Walker's bladder retractor.

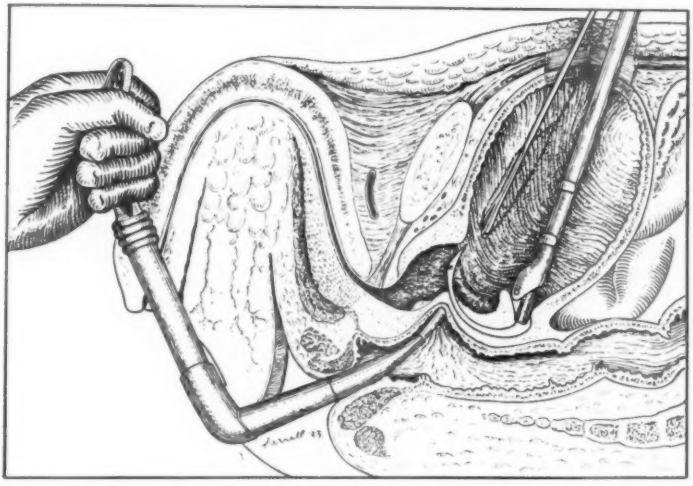


FIGURE V. Harris's needle engaging the *trigonum vesicæ* and a portion of the floor of the prostatic cavity elevated by the author's prostatic cavity elevator. Young's suture carrier holds catgut suture.

include all the space between the edge of the trigonal flap and the hindmost of the anterior sutures by means of two "U" or mattress sutures as shown diagrammatically in Figure VI. The medium or smaller Harris needle is used here, and deep, thick bites are taken.

Now a catheter is inserted, and here another modification is introduced. I have had made a special prostatectomy catheter, size 21 French, of ordinary Jaques shape, but not possessing any large eye; instead, the catheter is perforated by a series of small foramina, extending about eight centimetres back from the tip, in four rows (Figure VII). The distal four centimetres of the perforated portion lie on the bladder floor, while the proximal four centimetres lie in the partially obliterated prostatic cavity, as shown in Figure VIII.

FIGURE VII. The prostatectomy catheter.

When lotion is syringed through the catheter, it drives *débris* out of the prostatic cavity into the bladder, whence it is evacuated by the small de Pezzer drain which I always use suprapubically instead of closing the bladder completely. Urine is evacuated from the bladder partly through the distal four centimetres of the prostatectomy catheter, and partly through the de Pezzer drain. The prostatectomy catheter may be anchored in any way the surgeon prefers. I simply sew a loop of silkworm gut through the prepuce near the frenum and anchor the catheter to it by knotting the loop and then tying the gut fairly tightly around the catheter. On the patient's return to the ward, a few narrow strips of adhesive plaster are applied to take tension off the anchor suture, so that the latter will not cut through the skin.

After securing the catheter in position, the anterior transverse sutures which approximate the thick oozing sides of the anterior portion of the prostatic cavity are inserted. These are shown diagrammatically in Figure VI, as seen by the operator, and in a vertical sense in Figure VIII. These sutures, as Harris advises, are inserted with a wide bite, and skirt the depths of the cavity.

Closure of the bladder incision around a small de Pezzer drain, size 20 to 26 French, according to the presence of any infection and the completeness of hæmostasis, is preferable in my opinion to complete closure. Harris has drawn attention to bladder closure in

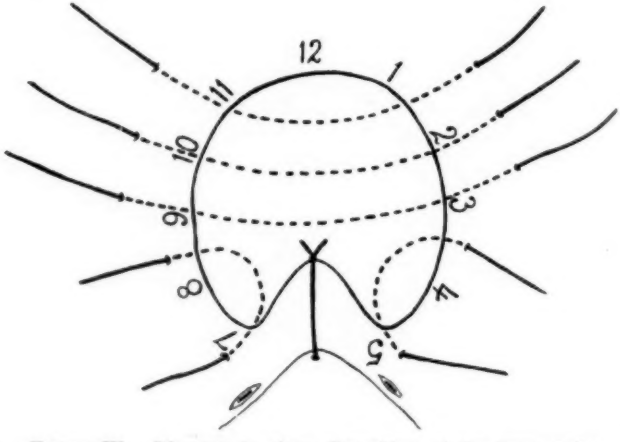


FIGURE VI. Diagram to show disposition of the hæmostatic sutures. Twelve o'clock on the imaginary clock face is on the anterior or pubic side.

the titles of his articles, whereas the surgical essential of his work is sutural hæmostasis of the bladder cavity. Closure of the bladder in a water-tight manner around a small de Pezzer drain gives the patient all the comfort and just as quick a convalescence as complete closure, and, in addition, possesses the advantage of providing free drainage and a way of opening the bladder should secondary hæmorrhage occur. The latter is very unusual, but I have had one case, and I fail to see how any surgeon can give an absolute guarantee against its occurrence.

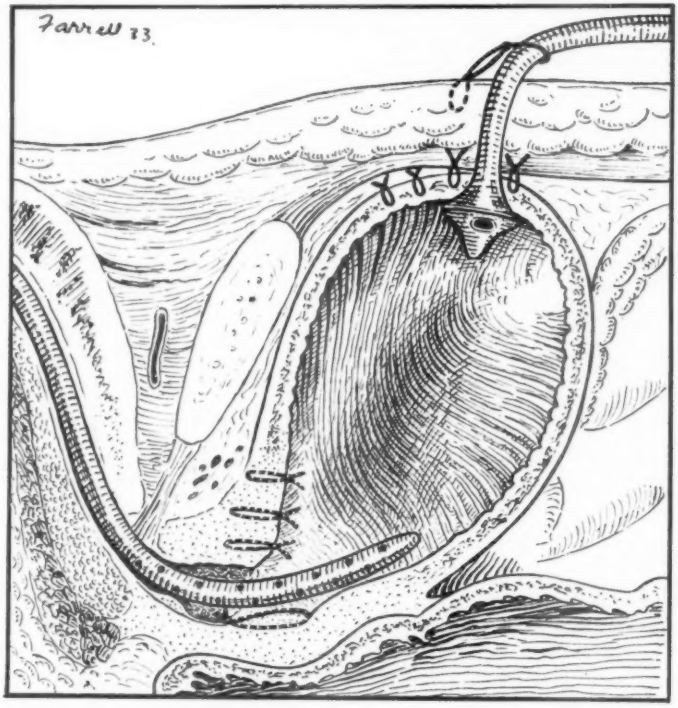


FIGURE VIII. Appearance at end of operation, when hæmostatic sutures, prostatectomy catheter and de Pezzer drain are in place.

Moreover, as already stated, the de Pezzer drain provides evacuation for the *débris* driven out of the narrowed prostatic cavity through my prostatectomy catheter.

One need not be in a hurry to remove the de Pezzer drain. In clean cases I remove it in seven days, when infection is present in about ten, but even fourteen should be considered if the surgeon prefers, though I find seven to ten sufficient.

The little sinus left on removal of the de Pezzer drain closes rapidly, and leaks little, if at all, if neatly strapped over a little gauze, for the prostatectomy catheter is retained in place. The latter is removed as soon as the sinus is nearly healed to the surface. This occurs in about fourteen days, or very little

longer, so that it is not unusual for the patient to be ready to leave hospital, as far as the wound is concerned, before he has had time to move about much and become strong on his legs.

Irrigation is exceedingly simple, and may be performed at any interval desired, without inconvenience, for the lotion passes through the prostatectomy catheter and out of the de Pezzer without even moistening the wound dressing. In the average case I like an eight hour interval. While any colour of blood is present I use a one in 16,000 solution of silver nitrate, very hot; afterwards a one in 8,000 solution of oxycyanide of mercury. With infected cases I find one in eight peroxide of hydrogen, preceded by mechanical cleansing with normal saline solution, very useful.

As seen in Figure VIII, the bladder wall sutures immediately above and below the issuing de Pezzer catheter are brought through the rectus muscle and its aponeurosis to aid obliteration of the prevesical space, which need not be drained. The expanded head of the drain is pulled up snugly against the anterior bladder wall. As the drain issues from the wound in the skin it is fixed by a loop anchor to the nearest skin suture, the ends of which are left long for this purpose.

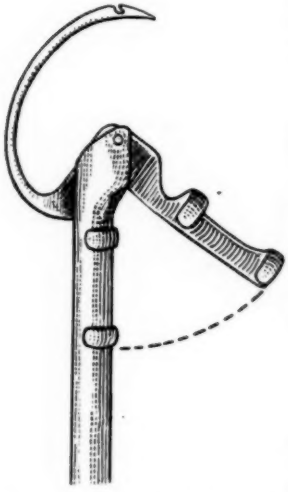


FIGURE IX. Clip designed to insure retention of the peg which keeps the needle in place in Young's boomerang needle-holder.

It was found, when using the boomerang needle-holder to sew through the thick, resistant muscular walls around the prostatic cavity, that the hinged peg which held the needle in place in the Young instrument was often forced out of place, with collapse of the needle and much annoying hindrance to the work. Mr. George Sinclair, of Elliott Brothers, Sydney, was asked to devise a means of retaining the peg in place. The excellent result of his endeavour is shown in Figure IX. The clip, which is easily removable in the manner indicated in the illustration, acts in such a way that no pressure on the needle will disturb the peg which retains the needle in place.

Two-Stage Prostatectomy.

For safety's sake, prostatectomy should be performed in two stages whenever catheter preparation fails to secure adequate improvement in renal efficiency, urinary tract infection or local congestion and œdema. Technical disadvantage appears, however, when an open hæmostatic operation is attempted in the second stage.

After five or six weeks, local infiltration has disappeared, and the abdominal wall layers can be dissected out nicely, and the bladder mobilized for good retraction, but it may not be necessary to wait so long, so a special technique in the first stage is called for.

I have devised a simple way of performing the cystostomy, so that later access is quickly and safely obtained, with a fairly long opening into the bladder, and no risk of injuring the peritoneum. These advantages are obtained whether the second operation is performed early or late.

In this technique a vertical incision is necessary, but it need not be long. When the bladder is opened, the distance from the internal meatus to the lower end of the bladder incision is measured with the forefinger. A 26 to 28 French de Pezzer drain is used for the cystostomy, and this tube should be placed at a full forefinger's length from the internal meatus, or more if easily obtained. The original cut into the bladder should be extended upwards far enough to secure

such disposition. In addition, the surgeon must see that the incision in the bladder extends downwards for about four centimetres below the tube.

Suture of the bladder wall is by interrupted catgut of number 3 thickness, passing through all coats and securing neat coaptation without any suspicion of eversion of the mucosa. One suture is placed at the very upper end of the bladder incision, immediately above the tube, with another immediately below the tube, so as to secure a perfectly water-tight closure.

The ends of the lowest suture of all are left long, and, as shown in Figure X, they are brought out through the rectus muscle and its aponeurosis. It is important to bring this suture through the muscle at about 1·5 to 2·0 centimetres above the lower end of the incision in the muscle layer. This important manœuvre dislocates the bladder upwards a little, and is the starting point of the essential part of this technique, which is to appose about four centimetres of incised bladder wall to the same length of abdominal wall incision, so that at the second operation one has all this length *plus* the portion for the tube for insertion of the bladder retractors; moreover, this opening lies definitely below the peritoneum.

The sutures immediately above and below the tube are left long and brought through the muscle and aponeurosis in the same manner as the lowest suture; the intervening sutures are cut short (Figure X).

In approaching the bladder during the second operation the various layers are incised in the same manner as at a primary operation, but, in addition, each layer is mobilized by centrifugal dissection with a flat scalpel movement. This especially applies when the bladder wall itself is reached, for adequate mobilization of the bladder wall is essential for good retraction.

In stout patients, use of the narrower lateral blades illustrated in Figure III renders visibility of the prostatic cavity quite practical; in such cases blades of the usual width may be impossible of insertion.

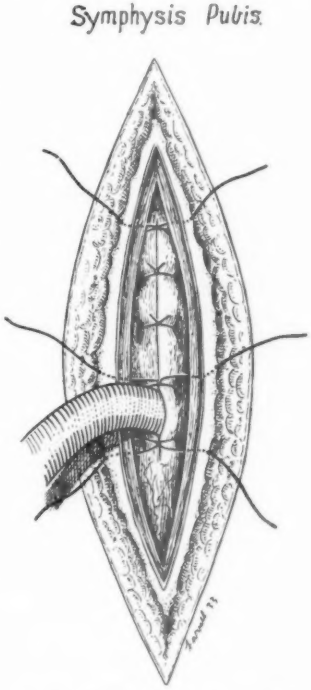


FIGURE X. Position of bladder incision and technique of placing sutures which close and anchor the bladder in the first stage operation.

The narrower blades, and the lamp attachment for the posterior blade of the Thomson Walker retractor, the prostatic cavity elevator and the special clip for Young's needle-holder were made by Elliott Brothers Limited, of Sydney. The same firm had the special prostatectomy catheter made for me in Paris.

References.

(1) S. H. Harris: "Suprapubic Prostatectomy", Transactions of the Australasian Medical Congress (British Medical Association), Supplement to *The Medical Journal of Australia*, October 1, 1927, page 241.

(2) W. E. Lower: "Complete Closure of the Bladder Following Prostatectomy", *The Journal of the American Medical Association*, Volume LXXXIX, September 3, 1927, page 749.

Case Reports.

REDUCTION OF A VOLVULUS BY A RADIOLOGIST.

By K. STUART CROSS.

[From the Melbourne Radiological Clinic.]

WHEN first examined, the patient was found to have a redundant loop in his distal colon, with some proximal stasis, and we reported that twisting of this loop, varying from time to time, might have something to do with the patient's trouble.

We did not see him again till twenty-one months later, when he came back with a recurrence of what were probably symptoms of partial intestinal obstruction. This time a clysma was administered, when a volvulus formation was demonstrated, as in Figure I.

Under fluoroscopic manipulation we succeeded in undoing the loop, rotating it through a complete 180° into the position shown in the second skiagram. The films were taken within three minutes of one another, both with the patient in the supine horizontal decubitus.

Many months later, on inquiring of his medical adviser, we were told that there had been no further symptoms since the patient got off the X ray table.

FIGURE I. Film taken eight minutes after starting administration of clysma; patient in the supine horizontal decubitus; showing twisted colon in "iliac" segment.

FIGURE II. Film taken three minutes later; patient's posture unaltered; loop undone.

DIRECT RADIOGRAPHIC DEMONSTRATION OF AN UNCALCIFIED PITUITARY TUMOUR.

By K. STUART CROSS.

[From the Melbourne Radiological Clinic.]

THE patient, a female, aged sixty-one years, was referred by Dr. Athol Blaubaum for investigation, with signs and symptoms suggesting a pituitary tumour.

Stereoscopic lateral views of the head (Figure I) showed discontinuity and considerable depression of the right side of the floor of the *sella turcica*, enlarge-

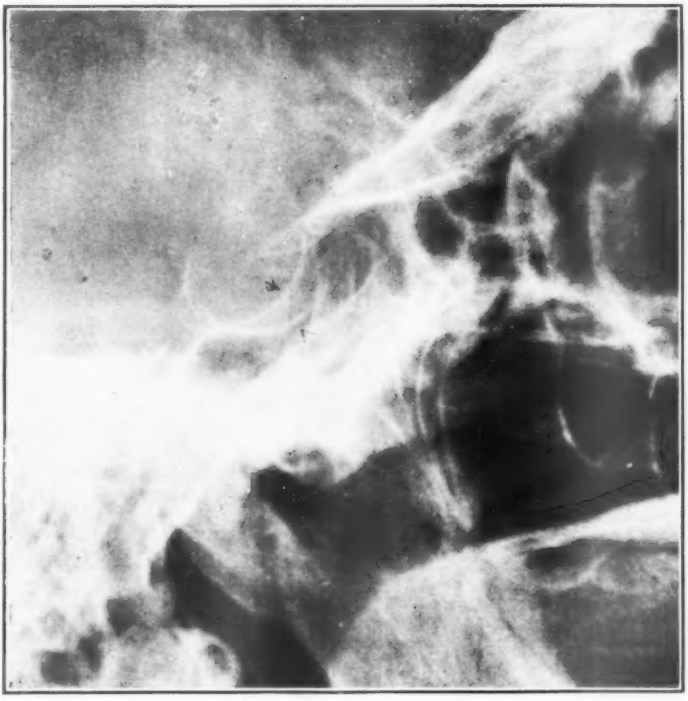


FIGURE I. Skiagram taken from the lateral aspect.

ment of the sella anteriorly beneath the right clinoid process, with shortening and blunting of the latter—classical indirect evidence of a unilateral intrasellar tumour. The most interesting thing, however, was the presence in the vertical view (Figure II) of a well-defined ovoid density superimposed on the anterior half of the right-hand compartment of the sphenoid.

It was reported as probably representing the actual tumour, though this seemed almost too good to be true. However, on opening the right sphenoidal sinus the tumour presented itself immediately as a blue pulsating mass. It was partly cystic and on being emptied returned into the skull, leaving a hole about the size of a threepenny piece (16 millimetres) in the right antero-lateral part of the sella. (This would be the discontinuity observed in the lateral view.)

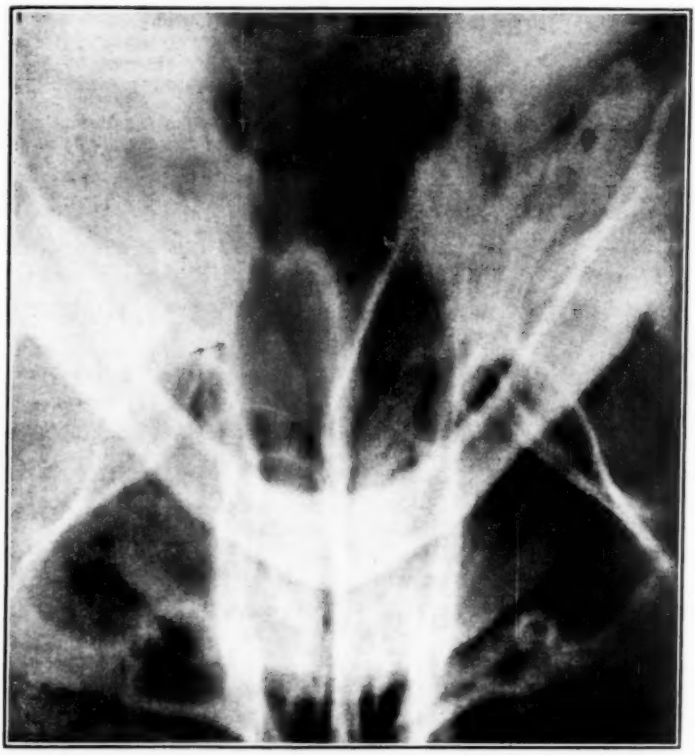


FIGURE II. Vertical view of tumour.

As. Dr. Blaubaum subsequently wrote, there can be no doubt that this film, in which the tumour is showing in the vertical view, must be a very rare one indeed.

Dr. Rupert Willis classed the tumour as a pituitary chromophobe adenoma.

It might perhaps be well to explain that in the "vertical" film there is considerable unavoidable distortion, especially in the way of antero-posterior elongation, due to the angle of incidence of the X rays on to the film.

Thus the ovoid shadow of the tumour would represent a more nearly spherical object. There is, of course, also general enlargement. The relationship of the various structures, however, is unaltered. In particular the architecture

of the sphenoidal sinus is demonstrated with the oblique septum and resultant relatively small antero-lateral left-hand compartment. This was also confirmed at operation.

FIGURE III. Diagram of Figure I.

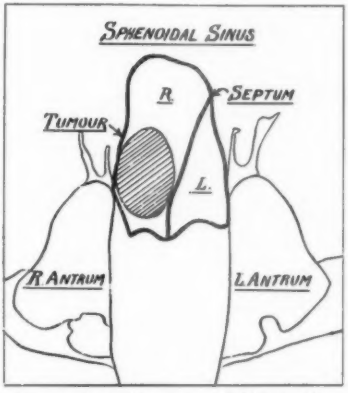


FIGURE IV. Diagram of Figure II.

I must thank Dr. Blaubaum for having originally referred the patient, and still more for his courtesy in having informed me so promptly as to the operative and pathological findings, and for his permission to publish the case.

ACCESSORY SPLEEN ASSOCIATED WITH CHRONIC INTESTINAL OBSTRUCTION.

By PAUL VOSS,
Rockhampton, Queensland.

Clinical History.

W.W. CALLED me to his home on July 8, 1932, when I found him complaining of very severe pain in his left hypochondriac region. His account of his illness was that he had had pain in this region on and off for a number of years, gradually increasing in severity and duration of attacks, till for the last two months he had been rarely free of pain. The pain was always in the same part, just beneath the left costal margin, and had been interfering with rest at night. He had lost weight, had no inclination for food, and found constantly increasing difficulty in securing proper action of the bowels. He had not had any vomiting, nor was there any relationship of the pain with eating.

On examination, I found his temperature and pulse rate normal. He had the appearance of suffering much pain. The whole abdomen was in a condition of tense muscular rigidity. In addition, he had painful cramps in the muscles of both legs. His tongue was moderately coated, except for the tip and edges, which were clean.

On his removal to hospital, plain enemata gave a very copious result of most offensive fæces, with considerable relief of his pain, and lessening of the muscular contraction of his abdominal wall, and disappearance of the cramps from his legs. The rapid improvement in his condition obviated the necessity for immediate exploration of his abdomen. For the next week, the enemata continued to give the same copious result, the stool still being very offensive and of old appearance. The general condition was improving considerably, the pain was lessening and was not so constantly present. The patient was then allowed to have an aperient, with immediate return of severe pain and deterioration of his condition. Opaque meal revealed nothing abnormal in the stomach, but showed a marked general visceroptosis. A barium enemata failed to reveal a new growth, but showed a very acute bend at the splenic flexure. The moving necessary for these examinations affected his condition so adversely that operation was postponed till it improved sufficiently to give reasonable chance of success, the pre-operative diagnosis being chronic obstruction, due probably to a band in the neighbourhood of the splenic flexure.

On August 8 the abdomen was opened through an adequate left rectus incision, the muscle being retracted laterally. On exposing the splenic region, a small quantity of free, greenish-yellow fluid was found. The spleen was found not adherent to the diaphragm and was freely movable. Running from the free border of the spleen to the splenic flexure was a band eighteen millimetres in length and three millimetres in thickness. This band was ligated and removed. There was now apparent on the anterior surface of the transverse colon, 2·5 centimetres from the splenic flexure, a dark red sessile body, in appearance much like the spleen. By dissection, the group of vessels in this body was exposed and ligated, the subsequent removal of the tumour being effected without difficulty. This tumour body was roughly spherical, eighteen millimetres in diameter, and solid in consistency.

Convalescence was uneventful, and the patient's general condition showed rapid improvement. He was able quickly to take ordinary light diet, and with paraffin emulsion the bowels began to move regularly and easily. The pain complained of before operation has completely disappeared.

The tumour removed at operation was examined by Dr. E. Marjorie Little, who reported that the tumour was composed entirely of splenic tissue (accessory spleen) and presents no abnormal histological appearance.

Comment.

This report is presented on account of the abnormal condition (accessory spleen) found at operation. Moynihan states an accessory spleen is present in 10% of cases, but does not mention the usual site of their growth. Nelson's "Surgery" states they are usually situated in the region of the hilus. Adami and McCrae state they are very common and usually situated near the main organ, but not necessarily. These statements seem to show that the condition is common, but not often productive of symptoms. In this case the growth of the small splenic body on the colon apparently so interfered with the normal peristalsis of the bowel as to cause, at first, a partial obstruction with localized peritonitis; during an attack of peritonitis the band between the colon and spleen was formed, which further aggravated the trouble, leading up to the condition found when the patient was first seen.

On January 17, 1933, the patient continues in good health without any return of the pain *et cetera*, complained of before operation.

The Australian and New Zealand Journal of Surgery.

All articles submitted for publication in this journal must be typewritten and double or treble spacing should be used. Each article should conclude with a brief summary and statement of conclusions. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without any abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal together with that of the journal in which the abstract has appeared, should be given, with full date in each instance.

When illustrations are required, good photographic prints on glossy gaslight paper should be submitted. Line drawings, charts, graphs and so forth should be drawn on thick white paper in India ink. Authors who are not accustomed to prepare drawings of this kind, are invited to seek the advice of the Editor if they are in any doubt as to the correct procedure. Skiagrams can be reproduced satisfactorily only if good prints or negatives are available.

VOL. III. JANUARY, 1934. No. 3.

SURGICAL TRAINING.

YOUNG surgeons in some Australian cities must often wonder whether they receive sufficient opportunities for an efficient training in surgery at public hospitals, both before and after appointment to the junior honorary surgical staffs of these institutions. Moreover, those interested in hospital management no doubt ask themselves whether the present system is adequate, not only for the making of a wise selection from among candidates for appointment to the honorary staff, but also for securing the proper surgical development of those appointed.

The training of the young surgeon should be on two main lines. First, and most important, is that of clinical experience, clinical observation and deduction, observation of post-operative results and the correlation of the whole into one setting. The other side—that of the operation itself—though important, should be looked upon only as an incident in the whole course of the case, and should not be the climax often staged to be a striking spectacle to the uncritical.

Operative technique, however, must still hold its place, and there should be no more room for the clumsy artisan in surgery than in a trade necessitating neatness and dexterity, where he would not earn his wage. The young man aspiring to surgery should serve an apprenticeship in manual dexterity—which is but seldom innate—in the operating theatre, in animal research work, and by the prosecution of some hobby which will inculcate neatness and manual craftsmanship.

To take the more important part first, that of clinical work and research, there should be a close liaison between the out-patient and in-patient departments. The junior surgeon and one or more selected clinical assistants in the out-patient department should have the opportunity of seeing all the clinical work in the wards of the corresponding senior surgeon, and thus receive the benefit of the senior's experience and advice. It should be impressed upon these men that they are expected to work in the wards, and they should be given every opportunity of doing this work in addition to carrying out their duties in the out-patient department. A junior surgeon or a clinical assistant should be responsible for the histories taken by the house surgeon, and should see that they are sufficiently accurate to furnish clinical and statistical data; and, further, he should undertake the compilation of case reports and summaries of the results of treatment of various diseases. In this manner, young surgeons will enlarge their clinical experience and increase their powers of observation and investigation. The senior surgeon should from time to time allot special lines of investigation to his juniors, and, to facilitate this work, the pathological department should at all times be open to these men.

As regards the operative side, young surgeons should be given opportunities to perfect their surgical technique and to acquire judgement by assisting the senior surgeon at difficult operations. The house surgeon naturally demands his share as first assistant at operations, but his work in this respect should be confined to those routine operations which he may later be called upon to perform in general practice, and for which his graduation degree fits him. He must be informed that it is unfair to the public that his surgical ambitions should be fostered by making him first assistant at delicate major operations at this stage in his surgical education. In operations pertaining to greater surgery, the place of first assistant should be filled by the junior surgeon or by a clinical assistant, selected from those men who will be candidates for vacancies on the surgical staffs of public hospitals. In this manner the education of young surgeons will be

continued and the senior surgeon will obtain skilled assistance at difficult operations.

Each man, when appointed to the honorary surgical staff, should be assisted at first by a senior surgeon until the latter is satisfied that the technique of the former is good enough to allow him to work without this supervision. It is probable that, if opportunities for better operative and clinical training are afforded in the manner indicated above to men in the period between a house surgeoncy and a staff appointment, the duration of this period of supervision can be materially curtailed.

For such a method to work successfully, it is necessary for the senior surgeon to be unselfish and to be willing to depute work to his juniors in order to assist and encourage them. Some of the operating work should devolve upon the junior staff, and no senior surgeon, except in exceptional circumstances, should undertake a large operating list of both major and minor operations which he himself completes in full, when he has an efficient junior staff. On the other hand, it is equally incumbent upon the junior surgeon and the clinical assistant to be keen, enthusiastic and helpful. It would be a potent stimulus to these men if it became the practice for a senior surgeon to furnish confidential reports on the efficiency of clinical assistants to the hospital board of management. Such reports would be of great value in regard to appointments to the junior honorary surgical staff. Indeed, it is to be hoped that, in the future, senior surgeons will be asked to report upon the work of junior members of the honorary surgical staff, so that the board of management will be able to dispense with the services of those men who neglect their opportunities. We should then be spared the spectacle of a young surgeon, who, after obtaining a position on the junior honorary staff of the hospital, is content to allow the lapse of time to elevate him undeservedly to a senior position on the staff.

R. B. WADE.

Surgery in Other Countries.

[In this column will be published short résumés of articles likely to be of practical value from Journals published in other countries and not readily accessible to surgeons in Australia and New Zealand.]

The Choice of an Anæsthetic.

The following abstracts are taken from recent contributions made from important Scandinavian and German clinics, and also by surgeons at the last International Congress of Surgery, which was held in Madrid in 1932. These statistics and opinions obtained from workers in Continental clinics, who, for some time past, have paid particular attention to the subject of anæsthesia, will, it is hoped, amplify the papers and discussions thereon included in the present issue.

Spinal Anæsthesia for all Subdiaphragmatic Operations.

Nils Backer-Gröndahl (Haukeland Sykehus, Bergen, Norway), *Acta Chirurgica Scandinavica*, Volume LXXI, December, 1932, page 51.

The author gives an account of 870 cases of spinal anæsthesia, in which he has used either "Percaine" or "Novocain". Spinal anæsthesia is now used in his clinic in 39% of all operations. It is only in major operations in the upper part of the abdomen that "Percaine" is used.

The spinal puncture is made either between the first and second or between the second and third lumbar vertebræ, and a solution of "Novocain", about 3·3% (0·10 gramme to 3·0 cubic centimetres of spinal fluid) is used—0·10 gramme for operations of short and 0·20 gramme for those of long duration, and five to six cubic centimetres of fluid if a high anæsthesia be required. The injection is made slowly, so that the injected fluid will form a separate layer. The patient is then brought into a Trendelenburg position, being tilted to an angle between 15° and 20°. The head of the patient is bent sharply forward, so that the chin rests on the breast bone. When using "Percaine" for spinal anæsthesia, the author follows the technique of Howard Jones. He tried Quarella's technique (two cubic centimetres of a one in 200 solution), but, because he experienced failures, abandoned it.

He points out that, in his experience, "Novocain", when used to induce spinal anæsthesia, is uncertain in its action in operations in the upper part of the abdomen, and that the use of "Percaine" has greatly overcome this difficulty. He finds that inhalation anæsthesia has often to be used as an auxiliary, because the patient is anxious, or because spinal anæsthesia does not last long enough. In these circumstances only a very light inhalation anæsthesia is necessary. In the operation of partial gastrectomy, when high spinal "Novocain" anæsthesia is used an auxiliary general anæsthetic is required in 50% of cases, and in gastro-enterostomy in 24% of cases. With "Novocain" the help of a general anæsthetic was needed in a much larger percentage of cases than when "Percaine" was used.

In 10% of cases the anæsthesia failed either partially or entirely to take effect.

In three cases, very high anæsthesia suddenly developed. This was accompanied by a marked fall of blood pressure, respiratory disturbances, and weak pulse. These patients improved rapidly after injections of "Ephedraline" and "Cardiazol", so that the operations could be carried out.

Cessation of respiration occurred in four cases. In none of these was an unusually high anæsthesia present, and the patients all recovered with appropriate treatment.

Headache occurred in about 15% to 18% of the cases. Backer-Gröndahl's statistics show that headache is more frequent in patients under forty years, and more frequent and more severe in women than in men. In the 870 cases, the incidence of headache is the same whether "Percaine" or "Novocain" is used, and whether a needle of small or of large calibre is employed.

The author makes comparisons between pulmonary and vascular complications in spinal and in ether anæsthesia. In the following table he compares the degrees of incidence of lung complication in all operations:

Type of Anæsthesia.	Numbers of all Operations.	Lung Complications.	Deaths.
Ether anæsthesia	681	41 = 5·8%	3 = 0·4%
Local anæsthesia	338	16 = 4·7%	1·0%
Spinal anæsthesia	870	67 = 3·1%	4 = 0·46%

In the following table he compares the degrees of incidence of pulmonary complications in a selected group of abdominal operations carried out on adults:

Type of Anæsthesia.	Numbers of Operations.	Lung Complications.	Deaths.
Ether anæsthesia	342	37 = 10·8%	2 = 0·56%
Local anæsthesia	105	13 = 12·3%	1 = 1·0%
Spinal anæsthesia	376	24 = 6·3%	3 = 0·79%

In this table it will be noticed that the figures for pulmonary complications are decidedly lower; they occur in about half as many cases as with other methods of anæsthesia. The relation between the incidence of thrombo-phlebitis in general and in spinal anæsthesia is seen in the following table:

Type of Anæsthesia.	Number of Patients over Twenty Years of Age.	Thrombo-phlebitis, Embolism.	Deaths.
General ether anæsthesia	697	27 = 3·9%	3 = 0·43%
Spinal anæsthesia	870	41 = 4·7%	3 = 0·34%

In all tables it will be noticed that the mortality following operations with spinal anæsthesia is not much different from that with ether anæsthesia.

H. B. DEVINE.

Experiences of Spinal Anæsthesia with "Percaine".

Ernst Tengwall (from the Surgical Section of the County and City Hospital, Hälsingborg), *Acta Chirurgica Scandinavica*, Volume LXXII, December, 1932.

THE strength of the "Percaine" solution used by the author is 1 in 1,000, and the "Percaine" is dissolved in a common salt solution in the proportion of 0·9 in 1,000. The solution is freshly prepared, and has a specific gravity of 1·009; it

is heavier, therefore, than the cerebro-spinal fluid. The injection is made while the patient is in a sitting position, and he is then quickly laid down on his back on the operation table, with the head well flexed; the head end of the table is then lowered to a suitable degree to allow the injected "Percaine" solution to sink and anæsthetize the spinal cord as high up as is desirable. The anæsthesia is usually complete after twenty minutes, and the patient is then moved from the Trendelenburg to the horizontal position. Ephedrine (0·05 gramme) is injected prior to the lumbar puncture. The height to which the operator wishes the anæsthetic to take effect determines the quantity of "Percaine" solution injected and the intravertebral space selected for the injection.

For operations on the lower extremity and the perineum, five to six cubic centimetres are injected between the third and fourth lumbar vertebræ; for operations on bladder and prostate gland, six to seven cubic centimetres are injected between the second and third lumbar vertebræ; for operations on the appendix, seven to eight cubic centimetres are injected between the second and third or the first and second lumbar vertebræ; for operations on gall-bladder and stomach, on kidneys and in intestinal or major gynæcological operations, eight to nine cubic centimetres are injected between the first and second lumbar vertebræ. A greater amount of anæsthetic fluid is injected in big or stout people. Tengwall used this form of spinal anæsthesia, with "Percaine" as the anæsthetic, in 250 operations. Reduction of blood pressure was of common occurrence. The greatest fall of blood pressure registered was 85 millimetres. In two patients, respiration ceased, but both recovered after artificial respiration. In no case was the spinal anæsthesia the cause of death, but "shocks" to patients as well as to doctors were not lacking.

Satisfactory anæsthesia was obtained in 70% to 80% of cases. In four cases the anæsthesia failed completely. When the anæsthetic effect was not satisfactory, a very small amount of ether sufficed to enable the operation to be carried out; so that, in these cases, the "Percaine" acted as a basal narcotic.

Tengwall also described his own experience. He was operated on for acute appendicitis. He rather wished to have the "Percaine" method tried on himself, and the first assistant who performed the operation injected eight cubic centimetres of "Percaine" solution between the first and second lumbar vertebræ. He felt nothing of this beyond the pricking in the skin for the local anæsthesia, and some dull sensation in the back when the needle was carried further in. He had no sensation of the needle being pushed into the dura, nor of the "Percaine" solution being injected. The blood pressure fell, and concurrently with this there came a certain degree of nausea, with a slight feeling of anxiety and cold sweating, accompanied by pallor and mild cyanosis. Blood pressure fell by 70 millimetres, and the lowest pressure recorded was 70 millimetres. The anæsthesia was so complete that, during the whole operation, he had no feeling of being touched in the operation field.

H. B. DEVINE.

Contributions on Anæsthesia.

The Ninth Congress of the International Society of Surgery, Madrid, April 15 to 18, 1932, *Journal de Chirurgie*, Volume XXXIX, June, 1932.

J. GOYANES (Madrid) reports on a method of inducing anæsthesia by arterial injection. This method permits any surgical operation to be carried out on the upper limb. The technique consists of blocking the distal end of the limb by means of an elastic ligature. A 0·5% solution of "Novocain" is then injected into the radial artery, which has been exposed at the wrist. The quantity injected varies according to the height of the lesion. A second ligature is used to limit the anæsthetic zone. The technique is very simple, and the results are excellent, because the effect of the anæsthetic is of practically indefinite duration, and lasts as long as the ischæmia.

NOBORU ISHIKAWA (Japan) employs local anæsthesia for his operations on the various abdominal viscera. He finds that the sensibility to pain of abdominal

organs and of different parts of the abdominal cavity varies very much. The liver and spleen are quite insensitive. The pancreas is very sensitive. The anterior gastric plexus, the vessels round the smaller curvature of the stomach and the pylorus, the plexus of nerves and the vessels along the common duct, the cystic duct and the hepatic duct, the vessels of the caecum, particularly its principal vessels, and the artery of the appendix, are also very sensitive to pain. Splanchnic anæsthesia is not sufficient to make the stomach insensitive; the vagus nerves must also be anæsthetized. In operating on the upper part of the abdomen, Ishikawa employs 0·5% "Novocain" regional anæsthesia in order to make the incision insensitive. He then uses Mandyl's "diffusion anæsthesia" in order to produce what he calls vago-sympathetic anæsthesia. He proceeds as follows: After having opened the peritoneum, he injects 50 to 100 cubic centimetres of a 0·05% solution of "Percaine" into the upper part of the abdominal cavity. He waits five minutes, and then injects 50 to 100 cubic centimetres of the same solution in the space under the diaphragm; this is intended to anæsthetize the vagus and the sympathetic plexus round the cæliac axis. After waiting for another five minutes, he anæsthetizes the anterior gastric plexus by using more "Percaine" solution. He uses adrenaline with the "Percaine" solution. He considers that the employment of 300 cubic centimetres of a 0·05% solution presents no danger to an adult.

H. B. DEVINE.

Intravenous General Narcosis with "Evipan".

Professor Wendel (Surgical Clinic of the Municipal Hospital of Maddeburg-Sudenburg), *Der Chirurg*, April, 1933.

"EVIPAN" is a sodium salt of N-methyl-C-C-Cyclohexenylmethylbarbituric acid. It is one of the most recent of intravenous anæsthetics, and is somewhat similar in its action to "Pernocton". But, as the interval between the fatal and the anæsthetic dose is great, and as the drug is quickly broken up in the body, it is supposed to be a safer anæsthetic. This drug is given by intravenous injection in the form of a 10% watery solution. It can be used as a basal anæsthetic in the same way as "Avertin", or as a general anæsthetic without any complementary ether or nitrous oxide. As a basal narcotic, it is most satisfactorily used with either nitrous oxide or ether. The dose given by the manufacturers is seven cubic centimetres of "Evipan" for 50 kilograms of body weight, and 0·5 cubic centimetre for every additional five kilograms, until 10 cubic centimetres are given. The injection is made very slowly. Where it is used as a general anæsthetic, the injection in small quantities is repeated when required.

Wendel's experience covers one hundred and sixty-one administrations. Seventy of these were pure "Evipan" anæsthesias, and were for operations like appendicectomy, cholecystectomy, nephrectomy. In most cases, however, complementary anæsthesia was necessary; and in these cases a very small amount of ether sufficed. Wendel reports very favourably on the use of "Evipan", and considers it is less toxic than "Avertin". He thinks that as a basal anæsthetic it is at least equal to "Avertin" given by the rectum, or to "Pernocton".

H. B. DEVINE.

Reviews.

THE DUODENUM.

The Duodenum: Its Structure, Function, Its Diseases, and Their Medical and Surgical Treatment. By EDWARD L. KELLOGG, New York; with a Foreword by G. D. STEWART, a chapter on Duodenal Parasites by BAILEY ASHFORD, and a chapter on X Ray Diagnosis by A. JUDSON QUIMBY. 1933. New York: Paul B. Hoeber. Pp. 855, with 287 illustrations.

"THE DUODENUM", by Edward Kellogg, of New York, forms a monumental compendium of 678 pages, followed by a bibliography of 130 pages.

Paré wrote: "Antiquity may seem to have nothing wherein it may exceed us beside the glory of invention, nor posterity anything left but small hope to add some things, as it is easier to add to former inventions." In his foreword Dr. Stewart wonders what Paré would say if he could see our books. We might well speculate on the wise practical surgeon's opinion of this type of compendium.

In this book is gathered all surgical knowledge respecting the duodenum, but whether the task of collecting together into one unit so much information so easily acquired elsewhere, justifies itself is another question. A compendium of this type is replete with massive grafts taken from standard works on different aspects of the subject, and there is necessarily little that is new or original. None would deny the value of certain chapters which serve to collate a large number of rare conditions, and undoubtedly help towards the crystallization of a definite therapeutic point of view.

The work opens with a most detailed account of the anatomy and physiology of the duodenum. Most people who are likely to possess this book are also likely to possess some modern textbooks on these subjects, and the value of the inclusion of such chapters may well be doubted.

There is a good historical review, and an excellent chapter on duodenal parasites.

A short section devoted to duodenal toxæmia might well have been included under the chapter on obstruction, in view of the fact that the supposed toxæmia is probably a purely obstructive phenomenon.

There is a most valuable section on duodenal diverticulosis, including tabulated details of the symptomatology, diagnosis and treatment of forty-seven cases. The surgical treatment of this condition appears to be satisfactory. One hundred and eighteen cases of chronic duodenal obstruction due to various causes are analysed in some detail.

The sections on perforation of ulcers is well done, the distinction between perforations of the full and empty stomach being emphasized. It is interesting that obliteration of liver dulness was not noted by the author in one hundred consecutive cases.

There is an interesting account of the value of radiography in the recognition of air in the peritoneal cavity after perforation. This may be seen fairly constantly between the liver and the diaphragm, and in rare cases might be a sign of some value.

In the treatment of perforation, gastro-enterostomy is recommended only where stricture exists or is produced by the operative infolding.

A TREATISE ON SURGERY.

A System of Surgery. Edited by C. C. CHOYCE, C.M.G., C.B.E., B.Sc., M.D., F.R.C.S., Professor of Surgery in the University of London *et cetera*. Pathological Editor, J. Martin Beattie, M.A., M.D., C.M., M.R.C.S., Professor of Bacteriology in the University of Liverpool *et cetera*. Third edition. In three volumes, medium 8vo. Volume I, pp. 1,112 + xxiv, with 33 colour and 67 half-tone

plates, and 285 illustrations in the text. Volume II, pp. 1,111 + xvi, with 16 colour and 11 half-tone plates and 367 illustrations in the text. Volume III, pp. 1,107 + xvi, with 11 colour and 39 half-tone plates and 277 illustrations in the text. 1932. London: Cassell & Company, Limited. Sydney: Angus & Robertson Limited, 89-95 Castlereagh Street.

THIS "System of Surgery", which was designed for the practitioner of surgery who desired to keep himself abreast of the most modern teaching, and for the senior surgeon who aimed at sound and comprehensive knowledge of modern surgery, has reached its third edition. In this last edition many of the articles have been revised, others have been rewritten by new contributors, and new ones have been added. In the preparation of the work, fifty-six leading British surgeons have collaborated with the editors, fourteen being new contributors.

The first volume differs little from the earlier edition. It is devoted chiefly to a consideration of surgical pathology and general surgery. A chapter on the surgical uses of radium, contributed by the late Dr. Birkett, is, however, new matter. In this chapter will be found a short description of the physical and chemical properties of radium, its methods of application, its dosage and its technique. The problems of treatment, considered from the point of view of the surgeon, are discussed in a practical way. This volume now contains the article on the breast, which is contributed by Sampson Handley.

In Volume II, notable chapters are those on the œsophagus, revised by Souttar; the stomach and duodenum, revised by Walton; the intestines, contributed by Miles and revised with the assistance of Paterson Brown; the liver, gall bladder and bile passage, contributed by Grey Turner; the upper and lower urinary tract, contributed by Sir John Thomson Walker; and the male genital tract, by Russell Howard. The chapter on the œsophagus contains a description of all modern methods of examination and some beautiful colour plates of the œsophageal appearances of carcinoma. The article on the stomach and duodenum in regard to the treatment of chronic ulcer reflects the sound pathological knowledge and the conservative operative methods of the British surgeon. In the article on the intestines it is surprising to find that, after resection of a carcinomatous growth of the colon, restoration of continuity by end-to-end or lateral anastomosis is the only method advocated. It would seem that some mention should have been made of the various modifications of Paul's method, which are so safe for the average surgeon. In the chapter on the upper and lower urinary tract, the author discusses the difficult and unsatisfactory subject of movable and floating kidney. It would appear that he holds the view that in this condition operative treatment is indicated rather more frequently than is generally believed. Various types of plastic operation for the relief of hydronephrosis are described, and some indication of the author's views as to the efficacy of these methods would have been welcomed here. A further indication for primary nephrectomy in calculous disease appears in the present edition: where such established infection or such large pockets are present, early recurrence is likely to occur. Few surgeons would venture to question the wisdom of this procedure. From his description of the operative approach to a stone in the pelvic ureter, the author does not appear to favour the combined transperitoneal and extraperitoneal method. In discussing the treatment of retention of urine following spinal cord lesions, Thomson Walker again expresses his belief that freedom from ascending infection of the urinary tract is best secured by immediate suprapubic drainage. The leaning of the Saint Peter's school towards internal urethrotomy in the treatment of stricture is very evident, this method being advocated even in chronic indurative periurethritis with fistulæ and abscess formation.

In the section dealing with the male genital tract, Russell Howard, in discussing the treatment of prostatic enlargement, appears to incline towards blind enucleation, with control of hæmorrhage by Hagner or Pilcher bag, rather than the open operation with suture control. Since no reference is made to the

use of the resectoscope in the treatment of prostatic obstruction, it is evident that the author does not yet consider this an established method.

In Volume III, among other valuable contributions, are to be found articles on the neck by Dunhill, and on the various branches of neurological surgery written by Jefferson, Trotter, and Julian Taylor—all of which contain much that is new. Dunhill has dealt with goitre in a manner that one would expect from a master of the subject. Basing his views on an enormous experience, he has simplified the classification of toxic goitre, and has correlated the histopathology with the clinical types. All kinds of hyperthyreoidism are grouped together under the term "toxic goitre". He points out that there is no essential difference between toxic goitre and "toxic adenoma". He believes that it is only a question of different manifestations, which vary according to their factors: the intensity of the stimulation, the state of the thyreoid epithelium, and the age and quality of the heart muscle.

In the section on the surgery of the peripheral nerves by Jefferson, a very complete and extremely able discussion of the subject is put forth, full recognition being given to the recent work on intraneural patterns, while the advances which have accrued from experience during and after the Great War, both as regards management and prognosis, have been incorporated. The section dealing with the surgery of the sympathetic system is short, and perhaps unduly conservative, but otherwise is a succinct statement of the subject. That dealing with the skull and brain, which is still associated with the name of Wilfred Trotter, is full, and maintains that high standard which has always been associated with this section of the work. In the short discussion of intracranial tumours, most of the important aspects have been considered. Emphasis is rightly laid on the importance of early diagnosis; and in this respect the necessity for repeated examinations and for active cooperation between clinicians is stressed. The addition of a section dealing with trigeminal neuralgia which is fully discussed in all aspects, corrects an important omission in some past editions, while the chapter on the spine and spinal cord, as in previous editions, is a full and able summary of our present knowledge.

Diseases of the bone are dealt with by Choyce. He advocates conservative methods in the treatment of osteomyelitis, and advises free incision of the periosteum and a limited removal of bone. He deprecates the old methods of free "guttering" of the affected bone.

Hey Groves, in the article on fractures, gives an illustrated account of a new method of treating a fractured patella by means of a strip of *fascia lata*.

There are twenty-nine new plates, and two hundred and ten new illustrations in the text, in addition to those in previous editions.

This "System of Surgery" may be regarded as a most satisfactory example of the teaching of British surgery, and one of the most important treatises of surgery at present extant in Great Britain.

Proceedings of the Royal Australasian College of Surgeons

ANNUAL MEETING.

THE annual meeting of the Royal Australasian College of Surgeons was held at Sydney in April, 1933. On April 12, 1933, a meeting was held at the Robert H. Todd Assembly Hall, British Medical Association House, 135 Macquarie Street, Sydney.

Anæsthesia.

GEOFFREY KAYE (Melbourne) read a paper entitled: "Anæsthesia" (see page 235).

J. M. BUCHANAN (Melbourne) read a paper entitled: "Gynæcological Anæsthesia" (see page 248).

WILFRED VICKERS (Sydney) offered his sincerest congratulations to Dr. Kaye for his most excellent paper. He spoke very strongly in favour of any form of safe premedication which would limit the amount of ether that had to be administered. The further benefits which could be derived from successful premedication were the prolonged amnesia before and after operation. He confessed to being greatly attracted by paraldehyde. It was extremely easy to administer and was cheap, and overcame, to some extent, one of Dr. Kaye's objections, that of administering an anæsthetic taking body weight as a criterion. He submitted the following points concerning the use of paraldehyde as a preliminary medication in anæsthesia. He dealt first with dosage, and discussed it under several headings.

1. The first group was children under seven and sick or undersized children over this age, very old and feeble subjects and those with low blood pressure, toxic and shocked patients and those who had recently lost much blood, patients with a high temperature, especially if it had lasted some days. For these persons the dose was one drachm per stone in ten drachms of saline solution given *per rectum* one and a half hours before operation.

2. The second group comprised children over seven. For these the dose was: Morphine, one-fortieth of a grain per stone, given two hours before operation; paraldehyde, one drachm per stone, given one and a half hours before operation.

3. The third group comprised normal adults. For these the dose was: Hyoscine, one two-hundredth of a grain, two hours before operation; morphine, one-eighth of a grain, two hours before operation; paraldehyde, one drachm per stone, one and a half hours before operation, up to a maximum of eight drachms.

4. The fourth group comprised patients with hyperthyreoidism, very nervous patients, athletes over twenty-five years of age, alcoholics. For these the dose was: Hyoscine up to one one-hundredth of a grain, with morphine up to one-sixth of a grain, given two hours before operation; paraldehyde, one drachm per stone, up to a maximum of ten drachms.

After the preliminary hypodermic injection, the room was darkened, the eyes were covered and wool was placed in the ears. After the paraldehyde was administered, the patient went to sleep in about fifteen minutes. This sleep deepened and in from twenty to forty-five minutes it was impossible to arouse him. The conjunctival, but not the corneal, reflex disappeared. The muscles were flaccid, but a painful stimulus called forth movement or rigidity of muscle lasting some minutes. An average patient would remain asleep for about six to ten hours without moving, and would usually have no memory of events up to twelve to eighteen hours after operation. It was not necessary to run off any paraldehyde remaining in the bowel after the operation. If desired, paraldehyde might be repeated when the patient showed signs of returning consciousness, 25% of the original dose being sufficient.

The advantages were as follows: (i) The removal of all nervous apprehension and mental distress. (ii) The prolonged state of unconsciousness obliterated the memory of the most painful and unpleasant part of the operation. (iii) The abolition or reduction of salivation, coughing or sweating during anæsthesia. (iv) The reduction of the amount of anæsthesia required. (v) The almost complete abolition of post-operative vomiting. (vi) The ease of administration and cheapness of the drug.

The disadvantages might be summed up as follows: (i) Young children did not retain the rectal injection very well. A morphine suppository was being used one-quarter of an hour before the rectal injection of paraldehyde, but Dr. Vickers's experience was not yet sufficient for him to comment on this. (ii) Nursing difficulties in very heavy patients. (iii) Lack of post-operative cooperation where this was required. (iv) These patients were usually very thirsty, and so the use of paraldehyde was inadvisable as premedication in operations on the stomach or small intestine when fluids had to be restricted.

Discussing post-operative care, Wilfred Vickers said that it was advisable to turn the patient from side to side every four hours. If he were restless,

morphine could be given. If the patient remained drowsy for a prolonged period, or if the respiration became too shallow, ephedrine, one-quarter to three-quarters of a grain, could be given, and acted promptly. Carbon dioxide might also be used.

VICTOR HURLEY (Melbourne) referred to one point raised by Dr. Kaye, and that was the question of certain advantages which might be conferred upon both patient and surgeon by some particular form of anæsthesia. He thought that very often these advantages were purchased only at a price, and he often asked himself the question whether they were worth the price which of necessity had to be paid. The advantages gained by gaseous anæsthetics were often more than counterbalanced by the difficulties of the operation, and he thought that very nice judgement was required on the part of both the surgeon and the anæsthetist in coming to a decision about the choice of anæsthetic for any particular case. He laid great stress upon the difference in the amount of ether that might be used by a skilled anæsthetist as compared with, for example, an inexperienced resident medical officer. In most abdominal operations the need for deep muscular relaxation existed only for a short time during the operation, and it was here that the skilled anæsthetist was able to cut down very greatly the amount of ether given to a patient. This, of course, had a great influence, he thought, on the post-operative sequelæ. He confessed to a liking for ether as a routine anæsthetic, except, of course, in certain conditions, such as toxic goitre, and in cases showing liver and renal failure, in diabetics and the like; in these he regarded the gaseous anæsthetics as indispensable.

H. S. STACY (Sydney) spoke with special reference to post-anæsthetic lung complications. He sincerely congratulated Dr. Kaye upon his small post-anæsthetic morbidity in this respect, and wished that he could reduce his complications to something approaching Dr. Kaye's figures. He had seen these complications, particularly in abdominal operations following types of anæsthesia other than that produced by inhalation methods. He accepted the usual explanation of post-operative atelectasis. In this condition, he had found carbon dioxide and oxygen very useful, and despite Yandell Henderson's explanation of its action in liquefying bronchial exudate and detoxicating bacteria, he felt that the good results that accrued from its use could be ascribed largely to increased pulmonary ventilation. As supplementary measures in these lung complications, he always liked his patients moved as soon as possible and frequently; stimulating expectorants were also given. He had been somewhat disappointed in the use of the carbon dioxide-oxygen mixture in bronchopneumonia, but had found it very useful in post-operative bronchitis. In some cases in which there were definite clinical signs in the lung, he had had radiographs taken, and the radiologist had reported that the area affected clinically presented the radiographic appearances of consolidation.

R. H. BRIDGE (Sydney) spoke with special reference to local anæsthesia in genito-urinary surgery. He had attempted infiltration anæsthesia in operations on the kidney, but without much success, for the technique was both difficult and tedious. He had had great success with parasacral anæsthesia in operations on the bladder and prostate. He pleaded for the recognition of "Percaine" in a one in 500 solution for use in minor operations on the bladder and urethra. It allowed, for instance, fulguration of a vesical papilloma or cauterization of the verumontanum with complete absence of pain. With "Percaine" also he had found that cystoscopy was invariably a simple procedure, except, of course, in cases of urinary tuberculosis.

R. F. O'SULLIVAN (Melbourne) said that he had to admit in the past to a strong prejudice against spinal anæsthesia. In the last few months, however, he had again tried this method and, although he had only sixty cases to report, they were all extremely successful, and he now felt very optimistic about the benefits which could be derived from the employment of spinal anæsthesia in gynæcological surgery. Of these 60 cases, 13 were perineal and 47 abdomino-pelvic operations. In all of them there was perfect relaxation and anæsthesia. After operation there was a delightful freedom from vomiting and shock, and there

was no case of troublesome abdominal distension. He did not think all women equally suited for spinal anæsthesia. In 40 of his cases the anæsthetic could be regarded as perfect; in the other 20 he thought that the fault definitely was due to incorrect premedication. He, therefore, thought that this aspect of the subject was very important in spinal anæsthesia.

RUPERT FURBER (Sydney) reported his experiences of 900 cases in which "Sodium Amytal" had been used in premedication. In the early cases, 70 in number, the intravenous method had been used, and up to twenty-five grains had been given. This dose had been found to be quite sufficient in any case, but after some time the dose was reduced, and he had found that usually a sufficient dose was one and a half grains per stone of body weight up to eight stone. After this, the dose was decreased proportionately, and now he regarded eighteen grains as a maximum dose; whether the drug was given orally or rectally, the effect was the same. He also drew attention to the fact that after operation the patients were asleep far longer than after the ordinary ether anæsthesia, and, therefore, the post-operative nursing was a very important factor. He regarded old age, obesity, cardiac disease and hyperpiesis as relative contraindications to employing large doses of basal narcotics, and in patients showing any signs of these conditions the dosage was stepped down very considerably.

BALCOMBE QUICK (Melbourne) challenged Dr. Kaye's attitude towards spinal anæsthesia in that he balanced advantages against risks. Despite some of the disadvantages, he felt that the interests of patient and surgeon marched hand in hand. Relaxation, even though accompanied by some degree of collapse, was so vastly advantageous to the patient as well as the surgeon that it was, he thought, unfair to balance the advantages of the anæsthetic against the risk to the patient. He asked what exactly they meant by risks. Were they sequelæ due to the spinal anæsthetic or risks to the patient's life at the time of operation? He had, at various times, for many years employed spinal anæsthesia and had never seen the patient die at the time of operation, although he had encountered more complications than, he had gathered, had been the experience of previous speakers. The only two cases he knew of, in which disordered function of bowel and bladder had occurred, were both in diabetics. In one, incontinence for six months occurred and then recovery. In the other, death occurred on the tenth day.

R. J. SILVERTON (Sydney) was of the opinion that "local" anæsthetics as a class were followed by easier nursing than "general" anæsthetics, and of the local anæsthetics spinal was the ideal. He thought that one of the great disadvantages of spinal anæsthesia, however, was the mental trauma inflicted on the patient and, in this respect, the basal narcotics were indispensable. He did not think spinal anæsthesia should be used as a routine measure, but he personally had used it a great deal in genito-urinary work. In recent years the method had reached something like perfection. Ephedrine was of great use in controlling the fall of blood pressure. "Novocain" and "Stovaine" possessed the slight disadvantage that their time of action was limited. "Percaine" gave longer anæsthesia, and he preferred a solution of one in 200 "Percaine" with 6% glucose, giving a specific gravity of 1023. With this solution, the old Barker technique might be employed with "Percaine". He had had experience of spinal anæsthesia in 3,000 cases, and there was not a death which could with fairness be attributed to the anæsthetic.

A. J. ASPINALL (Sydney) stated that, early in his career, he had given a large number of anæsthetics, and perhaps was very fully qualified to congratulate Dr. Kaye upon his most excellent paper. There was one point of the subject, however, which appeared to him to present somewhat of a problem. The list of basal narcotics and the number of mechanical contrivances for administration of the gaseous anæsthetics were increasing yearly. With all these innovations in anæsthesia, it seemed to him rather a problem to try to teach the medical student or resident medical officer to become an efficient anæsthetist. He thought that there might be a great danger of students never learning to become efficient in this matter, and he pleaded for simplicity in teaching, and thought that they

should all learn to become skilled in the use of ether without elaborate premedication.

F. A. MAGUIRE (Sydney) stated his preference for ether in general. In regard to "Avertin", he had been influenced by the repeated objections of many experienced sisters to its use, because the worry to them after operation had been considerable. If "Avertin" was used, he usually washed the bowel out after operation. Spinal anæsthesia did not appeal to him, because he thought that the puncture of the spinal canal and the induction into it of some foreign substance must of necessity occasion a risk, however small, of damage to the most delicate structure in the body.

F. MACKY (Auckland) stated that he thought it might be of interest for those present to know that chloroform was still used as the standard anæsthetic in Auckland, and was administered by house surgeons. As yet, in Auckland they had had no experience with ethylene. "Avertin" had been absolutely discarded. He used spinal anæsthesia, both high and low, a great deal and preferred it as a routine method in prostatectomy.

R. B. WADE (Sydney) gave, very succinctly, his choice of anæsthesia in children: As a rule, ether; in shocked or toxic children, ethylene; in short operations, ethyl chloride.

Dr. Kaye, in reply, said that the fullness and excellence of the debate, whilst rendering it of great educational value to an anæsthetist, at the same time precluded any attempt to reply in full. Accordingly, omission of any speaker's remarks from comment should be taken as implying agreement on Dr. Kaye's part.

Mr. Buchanan was to be congratulated on a series of spinal anæsthetic administrations of which the scientific honesty was beyond cavil, and of which the results much exceeded the average in regard to efficacy and safety. It was most helpful to encounter a series of spinal anæsthetics critically presented, and in which enthusiasm was not allowed to outrun analysis. The same feeling of admiration was to be felt for the series presented by Mr. Silverton and Mr. O'Sullivan. Dr. Kaye regretted that speakers had dealt with spinal anæsthesia in gynæcological rather than in general surgery. His own small experience had been gained in male general surgical patients, and he would have welcomed further opinions as to the supposed greater safety in female patients to which Mr. Buchanan referred, and which it seemed difficult to explain. Dr. Kaye's experience with ephedrine having been less satisfactory than was anticipated, he was impressed by Mr. Silverton's confidence in this drug; he could only assume that his own technique was imperfect. In reply to Mr. Quick, he failed to apprehend what was the point at issue, as he did not deny that it might be justifiable to take an added risk in one direction for the sake of an added gain in another. Whether, in a given case, the undeniable risk of circulatory embarrassment under spinal anæsthesia was justified by the probable gains from added muscular relaxation, was a question calling for nicety of judgement based on all the factors concerned. He was quite in accord with Mr. Quick in regard to spinal anæsthesia in cases of intestinal obstruction, as he had tried to bring out in the body of his paper.

In reply to Mr. Aspinall, Dr. Kaye said that he regarded the whole teaching of anæsthesia in Melbourne as eminently unsatisfactory. The present curriculum, whilst making the honorary anæsthetist *ex officio* an instructor in anæsthesia, rendered the instruction satisfactory to neither pupil nor teacher. It was only possible to give the student a working knowledge of "open" ether anæsthesia, this technique being chosen as more "foolproof" than "closed" ether. The keener and more promising students might receive some instruction in endopharyngeal and (in exceptional instances) endotracheal ether anæsthesia. Instruction in the use of gaseous anæsthetics and chloroform was, however, difficult, because patients receiving those anæsthetics usually suffered from some condition requiring the services of the anæsthetist in person. The present system of teaching was most unsatisfactory and required early and drastic revision.

NEW ZEALAND MEETING.

THE annual general meeting of Fellows of the Royal Australasian College of Surgeons resident in New Zealand was held at the Christchurch Hospital on September 8, 1933. Thirty-seven Fellows were present.

SIR LOUIS BARNETT, the Chairman, called attention to the mace which was brought in and laid on the table, and expressed appreciation of the Council's action in sending it to New Zealand for exhibition. He suggested that the Committee and as many Fellows as possible should wear gowns on special occasions in future and said that a design for a College gown had been approved and that the gown would shortly be available.

The Late Robert Hamilton Russell.

Sir Louis Barnett expressed the deep regret of the College in the great loss it had sustained by the death of Mr. Hamilton Russell. Fellows stood for some moments in silence.

Report of Hospital Committee.

In accordance with resolutions of the last annual meeting, efforts have been made to obtain progress in the directions indicated therein. A carefully drafted letter, setting out and explaining the attitude of the College in regard to surgical staffing, was sent to the Minister of Public Health, and copies thereof to the Director-General of Health and to the hospital boards and medical superintendents at the hospitals of Hamilton, Gisborne, Ashburton and Invercargill, in the hope that their institutions might be brought to adopt a visiting staff system instead of the closed or exclusive policy so persistently adhered to.

A meeting of such members of the Hospital Committee as were available, together with some co-opted Fellows whose advice was thought particularly desirable, was held in Dunedin on December 3, 1932, in order to draw up recommendations dealing with surgical staffing. These recommendations were circulated amongst the hospitals concerned and a personal visit was paid to Ashburton by Sir Louis Barnett and Sir Hugh Acland, who not only addressed the board, but met all the Ashburton medical practitioners beforehand at a specially arranged conference.

The Council of the College has expressed approval of the recommendations of the New Zealand Committee, condemned the one-man system of surgical staffing, and requested the New Zealand Committee to report on the subject of hospital grading. The Committee has given much thought and actual work to the important subject of hospital grouping, classification and grading, and has been greatly helped by the Director-General of Health through personal interviews and by correspondence.

The subject is a complex one, and involves careful consideration of geographical and political aspects, the classification of hospitals into the four main types—metropolitan, base, district and cottage—the best location and grouping of hospitals, the accommodation, personnel and organization of staffs, equipment, diagnostic and therapeutic facilities, maintenance of records *et cetera*. The Committee is of the opinion that the greater part of this work falls properly into the province of the Department of Health, but that assistance is required and would willingly be forthcoming from the Royal Australasian College of Surgeons and the New Zealand Branch of the British Medical Association.

The part played by the Royal Australasian College of Surgeons should obviously be chiefly concerned with the surgical aspects, and the Committee recommends that for the purpose of grading hospitals a schedule of the minimum surgical requirements for each type of hospital be drawn up and forwarded to the Director-General of Health with an offer to render further assistance if desired in the way of personal inspection of hospitals where the surgical organization seems to fall short of the desired standard.

The Committee is now engaged in the task of drawing up the schedule of surgical requirements referred to which, when completed, will be forwarded to the Director-General of Health for his consideration.

"The Australian and New Zealand Journal of Surgery."

The New Zealand Editorial Committee, which consists of the New Zealand members of the Editorial Committee of the Journal, reported that the New Zealand number of THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY, to be issued next April, was well in hand, and that a sufficient number of suitable articles was already promised.

The Hospital Committee.

It was resolved that the Hospital Committee should consist of the same personnel as the General Committee, and that the former should have power to coopt other Fellows as members.

Meetings of the College.

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Registered at the General Post Office, Melbourne, for transmission by post as a periodical.

VOL. III. APRIL, 1934. No. 4.

THE EVOLUTION OF THE DUNEDIN HOSPITAL AND MEDICAL SCHOOL: A BRIEF HISTORY.

By L. E. BARNETT,

Emeritus Professor of Surgery, Otago Medical School.

EIGHTY years or so ago the picturesque area of bush-clad country at the head of the Otago Harbour (Otakou in Maori language) was practically unknown, except to the native inhabitants and a few adventurous whalers and sealers.

The earliest actual Otago colonists came out in 1848 under the management of the New Zealand Company. They were in the main Scottish people belonging to the recently seceded Free Church, and they brought with them their own minister (the Reverend Thomas Burns, a nephew of the poet), and a planned determination to foster the religious and the educational ideals of their homeland.

They tackled their pioneering difficulties with marvellous courage and enterprise, and by the year 1861, with the aid of the later-coming immigrants, Dunedin had grown to be a town of some three thousand inhabitants, with extensive hospital accommodation consisting of a ramshackle collection of buildings in the Octagon, where the back part of the Town Hall now stands.

In 1861 began the dramatic Otago gold rush, and many thousands of gold seekers, traders and adventurers streamed into Dunedin from California, Australia and elsewhere on their way to the El Dorado of Gabriel's Gully and other alluvial fields situated sixty or seventy miles inland.

Dunedin, in an incredibly short space of time, increased its ordinary population to sixteen thousand, and became the largest and most important town in New Zealand. Shiploads of transients awaiting and preparing for their transport to the gold diggings and camped in barracks, tents and huts, swelled the crowded population to thirty thousand or more. Sanitation was awful, as can easily be imagined, accidents and bloody fights were numerous, and the hospital had to find room for over one hundred and fifty patients, not counting the forty or fifty mental patients who were also housed there.

should all learn to become skilled in the use of ether without elaborate premedication.

F. A. MAGUIRE (Sydney) stated his preference for ether in general. In regard to "Avertin", he had been influenced by the repeated objections of many experienced sisters to its use, because the worry to them after operation had been considerable. If "Avertin" was used, he usually washed the bowel out after operation. Spinal anæsthesia did not appeal to him, because he thought that the puncture of the spinal canal and the induction into it of some foreign substance must of necessity occasion a risk, however small, of damage to the most delicate structure in the body.

F. MACKY (Auckland) stated that he thought it might be of interest for those present to know that chloroform was still used as the standard anæsthetic in Auckland, and was administered by house surgeons. As yet, in Auckland they had had no experience with ethylene. "Avertin" had been absolutely discarded. He used spinal anæsthesia, both high and low, a great deal and preferred it as a routine method in prostatectomy.

R. B. WADE (Sydney) gave, very succinctly, his choice of anæsthesia in children: As a rule, ether; in shocked or toxic children, ethylene; in short operations, ethyl chloride.

Dr. Kaye, in reply, said that the fullness and excellence of the debate, whilst rendering it of great educational value to an anæsthetist, at the same time precluded any attempt to reply in full. Accordingly, omission of any speaker's remarks from comment should be taken as implying agreement on Dr. Kaye's part.

Mr. Buchanan was to be congratulated on a series of spinal anæsthetic administrations of which the scientific honesty was beyond cavil, and of which the results much exceeded the average in regard to efficacy and safety. It was most helpful to encounter a series of spinal anæsthetics critically presented, and in which enthusiasm was not allowed to outrun analysis. The same feeling of admiration was to be felt for the series presented by Mr. Silverton and Mr. O'Sullivan. Dr. Kaye regretted that speakers had dealt with spinal anæsthesia in gynæcological rather than in general surgery. His own small experience had been gained in male general surgical patients, and he would have welcomed further opinions as to the supposed greater safety in female patients to which Mr. Buchanan referred, and which it seemed difficult to explain. Dr. Kaye's experience with ephedrine having been less satisfactory than was anticipated, he was impressed by Mr. Silverton's confidence in this drug; he could only assume that his own technique was imperfect. In reply to Mr. Quick, he failed to apprehend what was the point at issue, as he did not deny that it might be justifiable to take an added risk in one direction for the sake of an added gain in another. Whether, in a given case, the undeniable risk of circulatory embarrassment under spinal anæsthesia was justified by the probable gains from added muscular relaxation, was a question calling for nicety of judgement based on all the factors concerned. He was quite in accord with Mr. Quick in regard to spinal anæsthesia in cases of intestinal obstruction, as he had tried to bring out in the body of his paper.

In reply to Mr. Aspinall, Dr. Kaye said that he regarded the whole teaching of anæsthesia in Melbourne as eminently unsatisfactory. The present curriculum, whilst making the honorary anæsthetist *ex officio* an instructor in anæsthesia, rendered the instruction satisfactory to neither pupil nor teacher. It was only possible to give the student a working knowledge of "open" ether anæsthesia, this technique being chosen as more "foolproof" than "closed" ether. The keener and more promising students might receive some instruction in endopharyngeal and (in exceptional instances) endotracheal ether anæsthesia. Instruction in the use of gaseous anæsthetics and chloroform was, however, difficult, because patients receiving those anæsthetics usually suffered from some condition requiring the services of the anæsthetist in person. The present system of teaching was most unsatisfactory and required early and drastic revision.

NEW ZEALAND MEETING.

THE annual general meeting of Fellows of the Royal Australasian College of Surgeons resident in New Zealand was held at the Christchurch Hospital on September 8, 1933. Thirty-seven Fellows were present.

SIR LOUIS BARNETT, the Chairman, called attention to the mace which was brought in and laid on the table, and expressed appreciation of the Council's action in sending it to New Zealand for exhibition. He suggested that the Committee and as many Fellows as possible should wear gowns on special occasions in future and said that a design for a College gown had been approved and that the gown would shortly be available.

The Late Robert Hamilton Russell.

Sir Louis Barnett expressed the deep regret of the College in the great loss it had sustained by the death of Mr. Hamilton Russell. Fellows stood for some moments in silence.

Report of Hospital Committee.

In accordance with resolutions of the last annual meeting, efforts have been made to obtain progress in the directions indicated therein. A carefully drafted letter, setting out and explaining the attitude of the College in regard to surgical staffing, was sent to the Minister of Public Health, and copies thereof to the Director-General of Health and to the hospital boards and medical superintendents at the hospitals of Hamilton, Gisborne, Ashburton and Invercargill, in the hope that their institutions might be brought to adopt a visiting staff system instead of the closed or exclusive policy so persistently adhered to.

A meeting of such members of the Hospital Committee as were available, together with some co-opted Fellows whose advice was thought particularly desirable, was held in Dunedin on December 3, 1932, in order to draw up recommendations dealing with surgical staffing. These recommendations were circulated amongst the hospitals concerned and a personal visit was paid to Ashburton by Sir Louis Barnett and Sir Hugh Acland, who not only addressed the board, but met all the Ashburton medical practitioners beforehand at a specially arranged conference.

The Council of the College has expressed approval of the recommendations of the New Zealand Committee, condemned the one-man system of surgical staffing, and requested the New Zealand Committee to report on the subject of hospital grading. The Committee has given much thought and actual work to the important subject of hospital grouping, classification and grading, and has been greatly helped by the Director-General of Health through personal interviews and by correspondence.

The subject is a complex one, and involves careful consideration of geographical and political aspects, the classification of hospitals into the four main types—metropolitan, base, district and cottage—the best location and grouping of hospitals, the accommodation, personnel and organization of staffs, equipment, diagnostic and therapeutic facilities, maintenance of records *et cetera*. The Committee is of the opinion that the greater part of this work falls properly into the province of the Department of Health, but that assistance is required and would willingly be forthcoming from the Royal Australasian College of Surgeons and the New Zealand Branch of the British Medical Association.

The part played by the Royal Australasian College of Surgeons should obviously be chiefly concerned with the surgical aspects, and the Committee recommends that for the purpose of grading hospitals a schedule of the minimum surgical requirements for each type of hospital be drawn up and forwarded to the Director-General of Health with an offer to render further assistance if desired in the way of personal inspection of hospitals where the surgical organization seems to fall short of the desired standard.

The Committee is now engaged in the task of drawing up the schedule of surgical requirements referred to which, when completed, will be forwarded to the Director-General of Health for his consideration.

"The Australian and New Zealand Journal of Surgery."

The New Zealand Editorial Committee, which consists of the New Zealand members of the Editorial Committee of the Journal, reported that the New Zealand number of THE AUSTRALIAN AND NEW ZEALAND JOURNAL OF SURGERY, to be issued next April, was well in hand, and that a sufficient number of suitable articles was already promised.

The Hospital Committee.

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